DECEMBER, 1952

APPLIED HYDRAULICS

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THE MAGAZINE OF FLUID POWER TRANSMISSION

INCLUDING AIR CONTROLS AND AIR CIRCUIT DESIGN; ELECTRICAL CONTROLS

Holiday greetings to all
from the Applied Hydraulics
Staff. We hope you have a joyous
Christmas and a peaceful,
prosperous year in 1953.

Listed on page 2 you'll find 10 articles and 7 regular departments which feature application and design ideas for fluid power equipment

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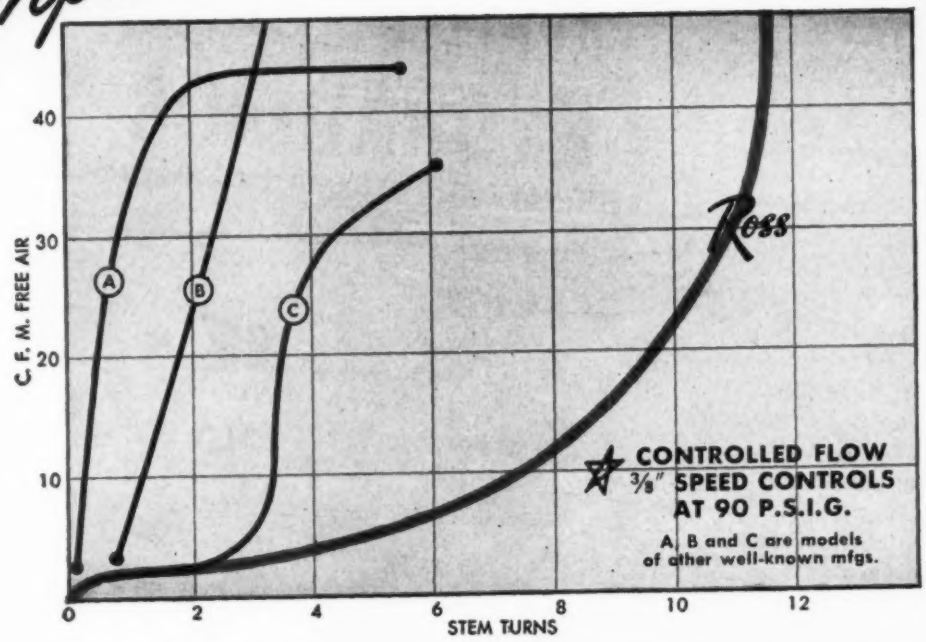

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- ☆ Simple, dependable, rugged
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ROSS OPERATING VALVE COMPANY

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Vol. 5, No. 12

APPLIED HYDRAULICS

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Published monthly, by THE HYDRAULICS PUBLISHING CO. an affiliate of INDUSTRIAL PUBLISHING CO., publishers of COMMERCIAL REFRIGERATION & AIR CONDITIONING, PRECISION METAL MOLDING, FLOW, INDUSTRY & WELDING, and OCCUPATIONAL HAZARDS. Member, Controlled Circulation Audit, Inc.

Subscription rates: United States and possessions—$3.00 per year, $5.00 for 2 years; Canada—$4.00 per year, $6.00 for 2 years; Foreign—$5.00 per year, except the United Kingdom. United Kingdom subscriptions £1.10 per year, payable in Sterling to our London Office. Single copy price, 30 cents. All subscriptions subject to individual acceptance by the publisher.

Published monthly, acceptance under Section 36.64 P.L.&R. authorized at Pontiac, Illinois.

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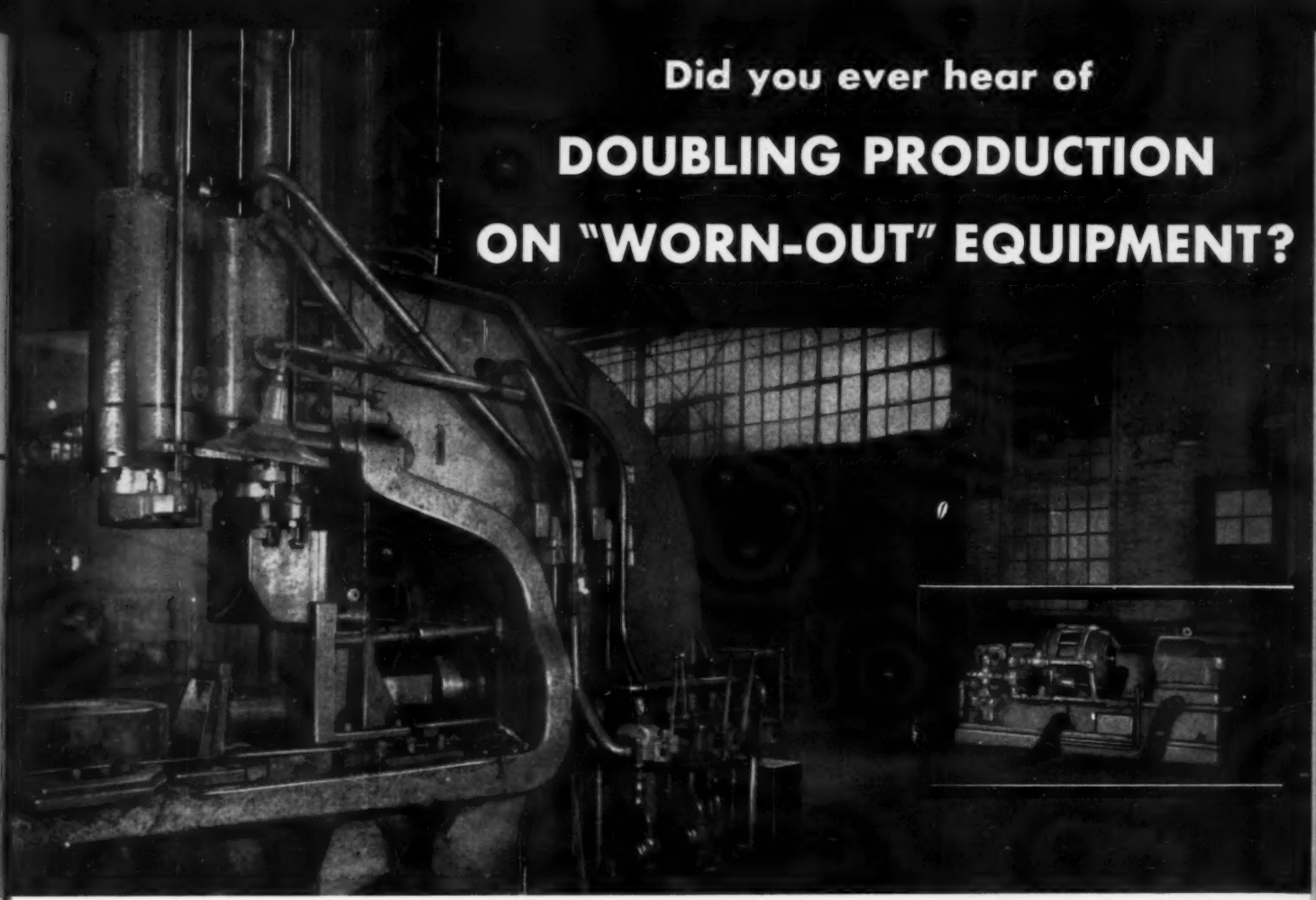


Did you ever hear of DOUBLING PRODUCTION ON "WORN-OUT" EQUIPMENT?

You may gain a valuable hint from this story how Treadwell renovated an old belling machine with Oilgear Fluid Power

The belling machine used for flanging big boiler ends in the Treadwell Corporation plant at Midland, Pa., has seen many years of service. The machine was slow, was "down" a lot, maintenance was high and production was off.

A careful analysis indicated that the press itself was not at fault; the trouble was associated entirely with the water pump, storage and accumulator system used to power the press gripping and main rams.

Two alternatives confronted the Treadwell people. One was to repair or replace the water system. This ran into a figure prohibitively high. It would not solve the problem of high maintenance, faulty control, erratic performance, the shocks inherent in the system, the slow cycles.

The Treadwell people chose the second alternative and called in an Oilgear Fluid Power engineering representative. This is what happened:

A standard Oilgear Fluid Power system was installed, without modification to the press. The only change was some rearrangement of the piping system. The cost was from one-fourth to one-third that of repair to or replacement of the water power system.

The operation of the rams was speeded up, the total time for each cycle cut from 66 seconds to 34 seconds. Therefore actual press production was almost doubled. Because the power medium used is oil, friction and wear become almost non-existent. The space required is slightly less than that required by the water pump, but the bulky water tank and accumulator were eliminated altogether.

The interesting thing about this Oilgear Fluid Power, which is smooth, shockfree and dependable is that from the one source, power travels to actuate the gripping rams, then while holding them at gripping pressure, travels over to the main or shaping ram and actuates it; then the same power retracts the rams in order and goes into "neutral" during the next handling step.

The above is only one of a number of similar press "renovations" being performed with the use of Oilgear Fluid Power.

Think of Oilgear Fluid Power as similar in every respect to electric power. It is generated, piped, and applied in the same way, with these **important** exceptions: Oilgear Fluid Power can be used in linear movement where electricity cannot. Oilgear Fluid Power speed can be varied steplessly, smoothly, infinitely where electricity cannot — or only with costly, troublesome, **extra** equipment. Oilgear Fluid Power can be "bled" off, dissipated harmlessly in case of shock. Oilgear is massive, tremendous, resistless power that can be controlled with micrometer precision.

It is probably the most amazingly versatile power there is. Consider Oilgear Fluid Power to improve the saleability of new machines, to renovate old machines, to solve a hundred troublesome problems where other power has failed to help. It costs you nothing to find out. THE OILGEAR CO., 1564 W. Pierce St., Milwaukee 4, Wis.

OILGEAR

OILGEAR

Fluid Power Lines

Your Buyer's Guide

The only Buyer's Guide in the fluid power field will reach you in January. APPLIED HYDRAULICS' third annual directory issue will contain an up-to-date product and manufacturers' listing of companies making electrical, hydraulic, pneumatic and mechanical components which are used on fluid powered machinery. Machine designers, tool engineers, maintenance supervisors and purchasing departments will find the 1953 Directory Issue a valuable information source throughout the year.

A separate section—Growing Horizons for Fluid Power—is being prepared to illustrate applications of fluid power in many fields from agricultural to woodworking.

Up The River

Just a stone's throw from our office, over to the Cuyahoga river, we found—with a strong assist from Bob Ryan who is fleet engineer for Great Lakes Towing Company—an interesting application of oil hydraulics. Going below decks of one of the lake tug boats was quite an experience. Aside from the hydraulic steering design which was the reason for our being there, we were impressed by the spotless condition of these boats. To landlubber Clevelanders, the Cuyahoga is a muddy, murky, winding stream lined by many old buildings and docks. Things are changing along the river—but boatmen tell us that inside those hard working tugs equipment has been clean for a long time.

What's the Right Pressure?

Myer Fox, who is chief electrical and hydraulic engineer at The Lapointe Machine Tool Company has written an article in which he tells why Lapointe is designing with low pressure hydraulic systems on their line of broaches.

While advocates of higher pressures can cite a number of advantages, it would seem that from Lapointe's viewpoint, before there is wide use of oil pressures over 1000 psi on machine tools, component manufacturers and machine builders will have to make a greater effort to inform the user on the care of high pressure installations.

Extra Dollars

We don't know how the economists would define "extra dollars" but to us it's dough over our expected income for which neither taxes or the wife has put in a claim. One very good way you can earn up to $500 in time to round out next summer's vacation is to prepare an article for the APPLIED HYDRAULICS Prize Paper Contest which has just started.

Write us for your entry blank and suggestion sheet. Articles on maintenance, application or design of both oil and air systems are being entered in this contest which is open until June 1st, 1953.

Overload Protection

Designers often select fluid power for their machines because protection against damage caused by overload is simply and effectively obtained.

When the designers of Allis-Chalmers' stone crushers were up against the problem of protecting the crusher mechanism from uncrushable material they chose a closed oil system. How this system automatically relieves the crusher cones and then resets them to the exact crushing position after tramp iron has passed is described in this issue.

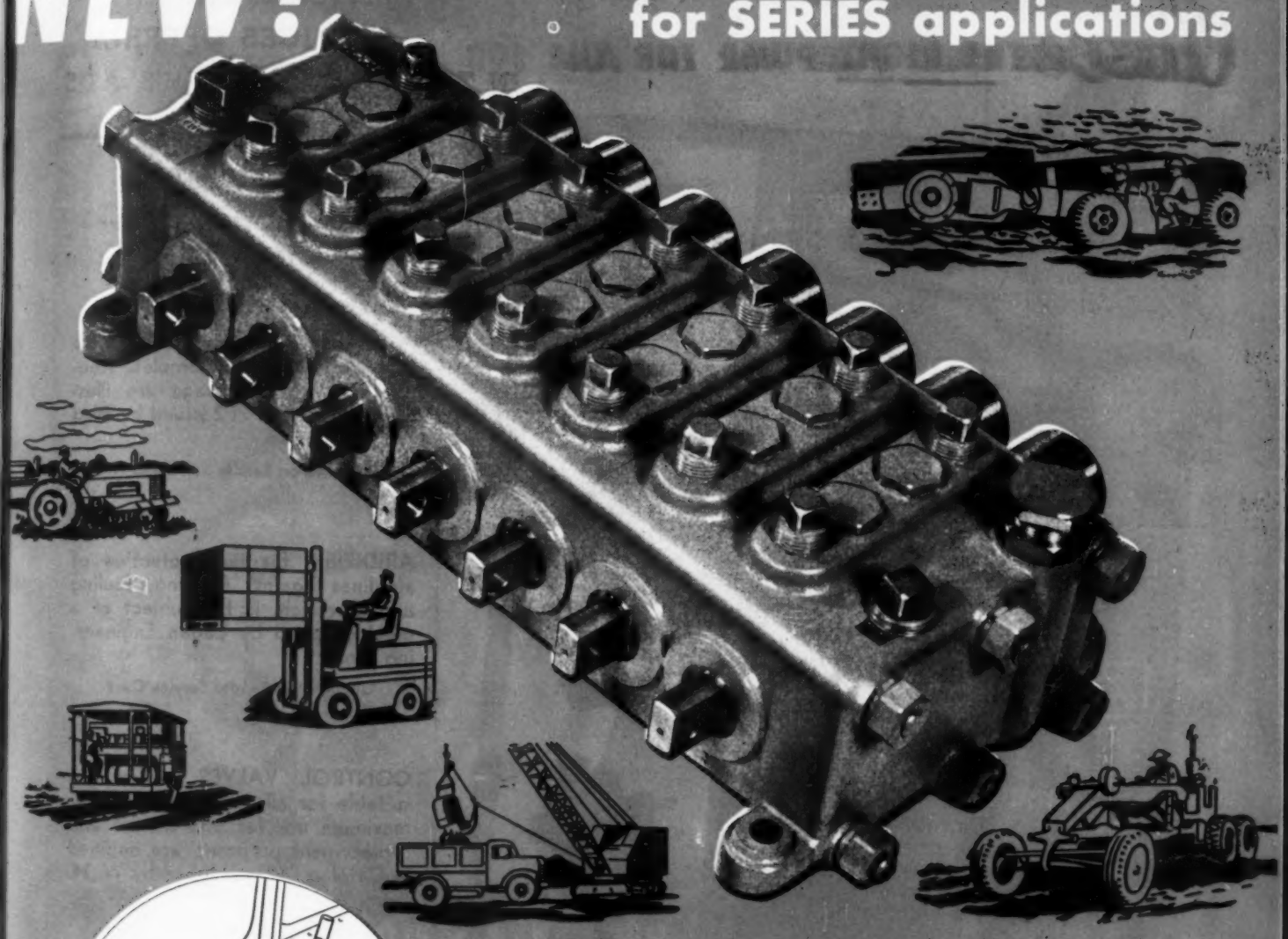
Out of Reach

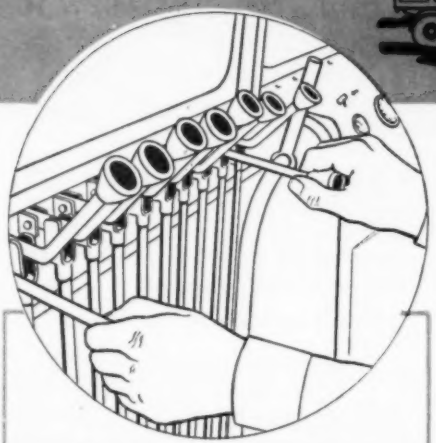
Today, when it is sometimes necesary to put a wall between the operator and the work, problems of remote control require considerable design time. Each job presents some new problem and requires a choice between various methods for permitting an operator, who is many feet away from the operation, to have full control. This month, Oscar Bieshelt, Columbiana Engineering's president has written an article describing the use of single tube master-slave units to remotely control a charging machine which is being used in Texas to transfer hot billets from a furnace to a forging press.

Pump-Motor Design

One of the most interesting developments in hydraulic components which was introduced during 1952 is described by John English, a member of Denison Engineering Company's development staff. The availability of an oil power unit which can be used interchangeably as a pump or fluid motor without changing internal parts is new.

NEW! 3/4" multiple section valve for SERIES applications





Continuous operation
SAVES TIME
SAVES MONEY
INCREASES SAFETY

operate two or more cylinders *simultaneously* under full or varying load!

No need to put up with time-wasting, intermittent operation of your hydraulic equipment! Now you can operate any number of cylinders or fluid motors *simultaneously* under full or varying load. This new, larger ¾" multiple section series valve is made up in individual sections, with up to ten controls in a single, centralized assembly. Check valves in each section assure positive control. Moreover, loads cannot be dropped or shifted as their direction is changed—positive cylinder movement is always maintained—no momentary reversal of the cylinder is possible as the stem is shifted. If you manufacture mobile equipment, get complete data on this new Sundstrand development—write, wire, or phone for your free copy of informative data bulletin No. 3104.

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For Hydraulic Mechanisms
For Oil Burning Service

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For Circulating Service

TUTHILL MODEL CK PUMPS
Ball-bearing construction
For Hydraulic Service

TUTHILL MODEL M PUMPS
For Coolant Service, with automatic internal by-pass

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For Lubrication Service (Model RC, non-relieving).
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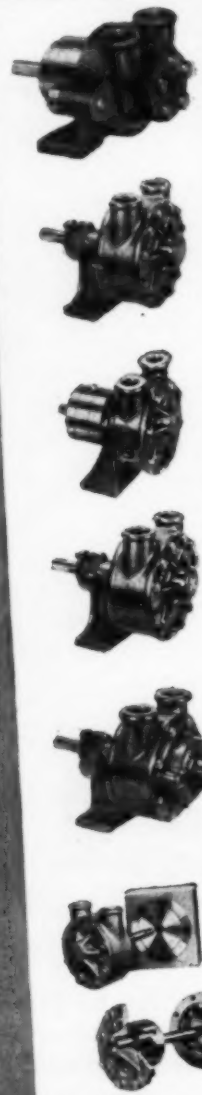
All standard models are available in stripped form for building into the design of your equipment.



To make it easy for you to choose the right pump for the job, Tuthill offers the handy new Pump Guide . . . a letterhead-size table which gives you full details on the complete line of Tuthill Pumps.

Write for your PUMP GUIDE today!

25th Anniversary

TUTHILL PUMP COMPANY
939 East 95th Street, Chicago 19, Illinois

Tuthill positive displacement internal-gear rotary pumps are serving industry on machine tools, engines, speed reducers, compressors, hydraulic mechanisms, special machinery and oil-burning equipment.

LITERATURE AND SERVICES OFFERED IN THIS MONTH'S ADS

For more information circle numbers on the reader service card bound in this issue.

PISTON RING SEALS for hydraulic cylinders which offer complete freedom from face leakage are illustrated in Bulletin H 2 issued by Burd Piston Ring Co.

Circle 10 on Reader Service Card

ARIDIFIER, for the protection of air lines against freezing, fouling and corrosion, is the subject of a catalog issued by Logan Engineering Co.

Circle 43 on Reader Service Card

CONTROL VALVES, which are suitable for all mediums, and offer maximum use for interchange and replacement purposes, are outlined in Catalog 552, published by W. H. Nicholson & Co.

Circle 50 on Reader Service Card

AIR PRESSURE REGULATOR which holds set pressure regardless of vibration or normal upstream pressure variations is outlined in Bulletin PH 10, offered by Conoflow Corp.

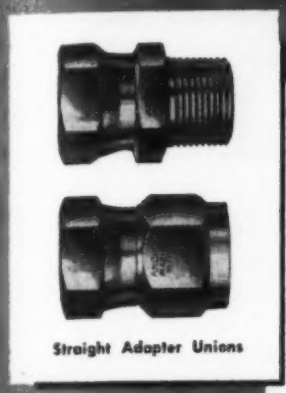
Circle 13 on Reader Service Card

INJECTION MOLDED "O" RINGS which meet specific requirements for hydraulic seals with close tolerances, are described in "O" Rings Bulletin, issued by the Minnesota Rubber and Gasket Company.

Circle 48 on Reader Service Card

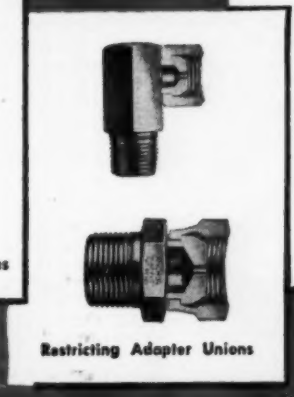
FLEXIBLE COUPLINGS which maintain correct alignment between hydraulic pump and its electric motor, are illustrated in a catalog available from Lovejoy Flexible Coupling Co. Also handy selector charts are included.

Circle 45 on Reader Service Card

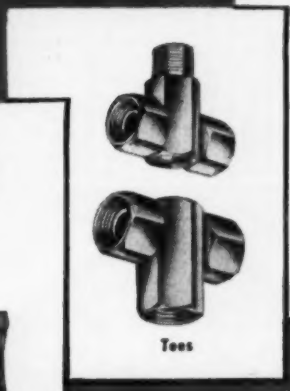


Straight Adapter Unions

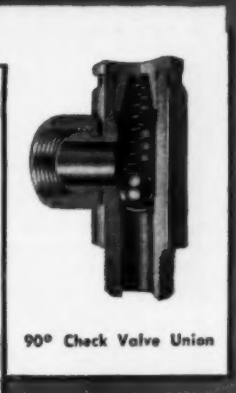
45° and 90° Adapter Unions



Restricting Adapter Unions



Tees



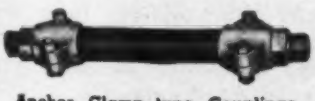
90° Check Valve Union

ANCHOR Adapter Unions

—Save You Assembly Time and Money

Anchor Ductile Sleeve Couplings assembled on two wire braid hose for high pressures.

Anchor Sleeveless Couplings assembled on either single wire braid hose or two rayon braid hose for medium or low pressures.



Anchor Clamp-type Couplings are ideal for field service use and emergency repairs. Easy to put on and take off—withstand high pressures.

Use Anchor Assembled Hose Units with the outstanding fittings shown above. You'll have less trouble in the shop on assembly — and less trouble in the field on the job.

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Time is money And whenever you save time, you reduce costs.

That's why it pays to use Anchor Adapter Unions and Related Fittings. You see, they're designed especially to speed the attachment of Anchor hydraulic hose assemblies to equipment of all kinds.

In addition to cutting assembly costs, Anchor Adapter Unions and Fittings have these important advantages:

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- You can connect and disconnect them many times without destroying the seal.
- Made from solid steel bar stock and plated to prevent rust, they stand up under the toughest service conditions.
- Their use lets you eliminate one or more pipe-thread joints—gives you a better piping job.
- Assembly in confined spaces is quicker and easier.

The Anchor line of Adapter Unions and Related Fittings is the most complete line available. Save yourself time and money—select those that fill your specific needs.

Send for complete information on Anchor Adapter Unions and Fittings

CLIP COUPON TO LETTERHEAD AND MAIL TODAY!

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Dept. AH-122, Libertyville, Illinois

I like the dependability, the safety, and the time-and-money saving features of Anchor Adapter Unions and Fittings. Please send me a catalog.

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Company_____

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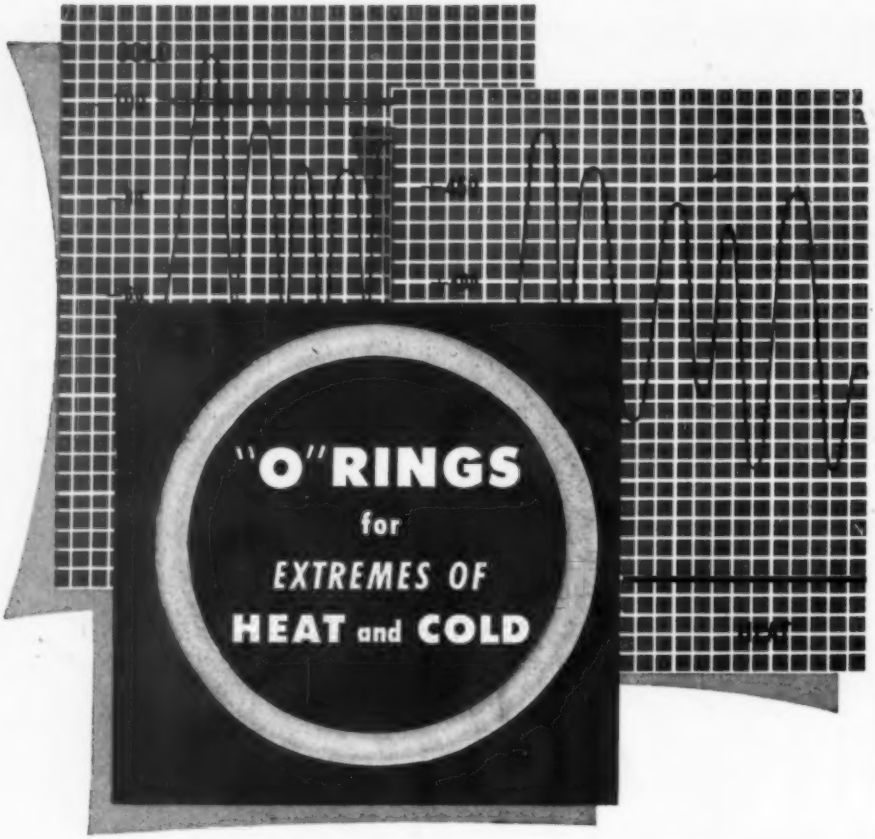

SILICONE "O" RINGS PERFORM OVER A W—I—D—E TEMPERATURE RANGE!

Avoid premature seal failures by selecting the proper "O" Ring materials. For "O" Ring applications that encounter temperature extremes as low as −110°F or as high as +480°F, the use of silicone "O" Rings is indicated. Silicone "O" Rings also provide excellent resistance to chemicals . . . weathering . . . oxidation and moisture. If you have an application requiring "O" Rings to maintain a seal for long periods at either very low or high temperatures, it will pay you to investigate the many properties of silicone rubber. All dash numbers of 6227, 6230 and 6290 series for industrial applications or Army-Navy installations to Specifications MIL-P-5516 (6227 and 6230) and MIL-G-5510 (6290) are available from stock. Silastics and other special compounds are available on order.

Catalog and engineering data on request. Write us today.

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Literature in this Month's Ads

Continued

AIR AND HYDRAULIC CYLINDERS are detailed in Bulletins H-104 and A-105 available from the Miller Motor Company.

Circle 47 on Reader Service Card

AIR CYLINDERS which feature new cushion design to insure positive cushion action combined with automatic valving action for fast return stroke, are described in Bulletin 252 published by Tomkins-Johnson Co.

Circle 75 on Reader Service Card

HYDRAULIC TUBING to fit the demands of tough application is described in literature offered by the Superior Tube Co.

Circle 73 on Reader Service Card

ROTARY PUMPS for hydraulic service are fully detailed in Catalog 952, issued by the Geo. D. Roper Corporation.

Circle 65 on Reader Service Card

GEAR TYPE HYDRAULIC PUMP, for long trouble-free service life is described with specifications and performance charts offered by the Pesco Products Division, Borg Warner Corp.

Circle 57 on Reader Service Card

MACHINE FOR MAKING HYDRAULIC HOSE ASSEMBLIES is discussed in Bulletin No. 8, available from Pyles Industries, Inc.

Circle 62 on Reader Service Card

METALLIC ROD WIPER which protects your cylinder rods, machine spindles, and guide pins, is outlined in literature available from Hydraulic Accessories Co.

Circle 35 on Reader Service Card

HYDRAULIC CONNECTIONS are described in Catalogs No. E-1457A and No. H-1457A available from the Weatherhead Company.

Circle 86 on Reader Service Card

Circle 60 on Reader Service Card

Literature in this Month's Ads

Continued

SOLENOID VALVES are described in a bulletin issued by the Automatic Valve Co. Included are three and four way pilot valves for operating master valves and small cylinders, speed control valves and three and four way pilot operated valves.

Circle 9 on Reader Service Card

LIMIT SWITCHES, hermetically sealed for positive protection against cold and heat, are discussed in catalog offered by Electro-Snap Switch & Manufacturing Co.

Circle 20 on Reader Service Card

DARCOVA PUMPCUPS, designed for reciprocating pumps and air and oil cylinders, are described in Bulletin 4401, prepared by the Darling Valve and Manufacturing Co.

Circle 15 on Reader Service Card

AIR COMPRESSOR PACKINGS, especially developed for air or gas compressors, with self lubricating sealing features, are outlined in Bulletin DMAH, available from Durametallic Corp.

Circle 18 on Reader Service Card

BLADDER TYPE ACCUMULATORS for increased efficiency on many hydraulic system applications are described in Bulletin 301, offered by Greer Hydraulics, Inc.

Circle 27 on Reader Service Card

OIL PURIFIER, which helps prevent trouble in hydraulic installations by keeping oil clean and free from damaging contamination, is described in a bulletin prepared by Honan Crane Corp.

Circle 34 on Reader Service Card

LEATHER AND SYNTHETIC PACKINGS are the subject of a 16 page "O" Ring booklet, with illustrations, application data and specification charts. The booklet is available from Graton & Knight Co.

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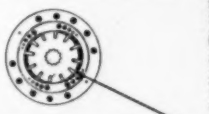
"The Finest Money Can Buy!"

in smoother, longer-lasting performance

Because of:

Radially Balanced Rotors

Dual, opposed inlet and exhaust porting provides radially balanced operation.



Hydraulically Balanced Vanes

Less load on cam ring . . . low loading characteristics at all operating pressures.

Simplified Design

Consisting of only three ruggedly built, close-coupled components. Pump/Motors assure extra stamina.

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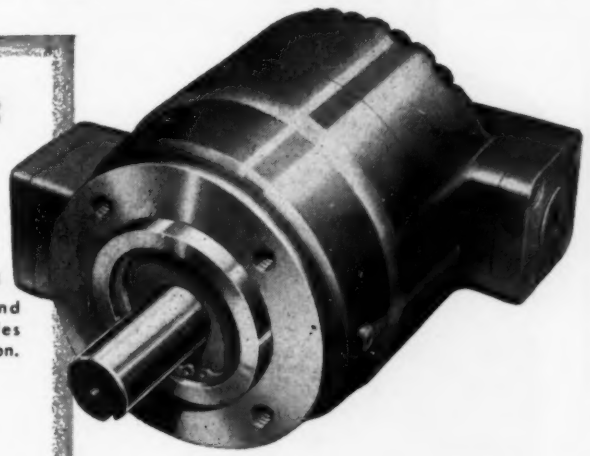
Delivering 7.5 gpm at 2000 psi, this typical Pump/Motor is only 4⅛" in width and height; only 8" long *including the shaft.*

Bi-directional Rotation

All Pump/Motors are quickly and easily convertible to counter-clockwise rotation, and operate with equal efficiency in either direction.



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Some of the features that give Pump/Motors this extra value are shown at left. In addition, their 3-unit construction makes it easy to alter the relation of inlet and exhaust porting for easiest installation. For better valving action, the heavy-duty Pump/Motor vanes feature dual, precision-machined sealing edges held in constant contact with the cam ring.

FOUR SIZES, each with a choice of interchangeable cam rings, offer pumping capacities from 2.7 to 70 gpm . . . or motor torque capacities from 13 to 257 pound-inches per 100 psi. *For smoother, longer-lasting, low-maintenance operation, specify Denison Pump/Motors.* Write for full details.

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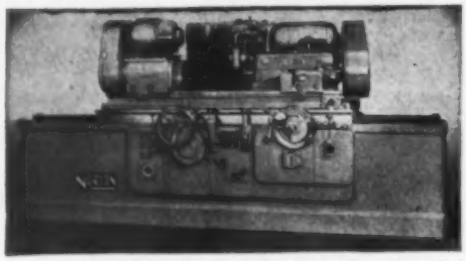
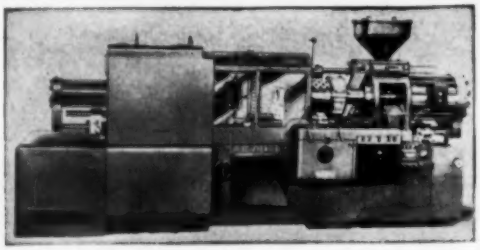
DENISON HydrOILics

PUMP/MOTOR



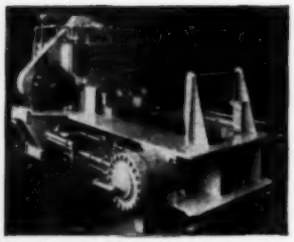
Norton Co., Manufacturer of Grinders, Specifies Marvel Syn-Clinal Filters as Standard Equipment.



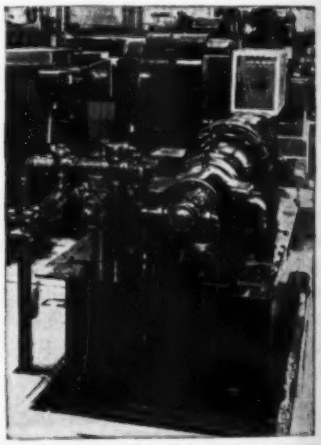
Superior Plastic Div. of Commonwealth Plastics, User, Installs Marvel Synclinal Filters on Their Hydraulic Injection Molding Presses.

Hufford Machine Works, Inc., Manufacturer of Stretch-Wrap Forming Machines, Specifies Marvel Synclinal Filters as Standard Equipment.

Euclid Road Building Machinery Co., Manufacturer, Specifies Marvel Synclinal Filters as Standard Equipment.



Hamilton Bridge Co., Ltd., Manufacturer of Balesters, Specifies Marvel Synclinal Filters as Standard Equipment.



U. S. Steel, User, Installs Marvel Synclinal Filters to Protect Their Hydraulic Equipment.

Line Type (cutaway)

SUMP TYPE (Cutaway)

Marvel Synclinal Filters The O.E.M. Choice of Over 300 Manufacturers

3 OUTSTANDING REASONS WHY:

REDUCED COSTS—Simple design, no moving parts to wear, nothing to keep in stock make Marvel Synclinal Filters an outstanding economy factor.

EASY MAINTENANCE—Because Marvel Synclinal Filters may be easily disassembled, cleaned and reassembled by any workman, maintenance "downtime" is reduced to the absolute minimum.

INCREASED PRODUCTION—Because of the balanced design, Marvel Synclinal Filters allow greater active filter area, permitting longer periods of "productive" operation.

A SIZE FOR EVERY NEED

Available in sump and line types, capacities from 5 to 100 g.p.m. Monel mesh sizes from 30 to 200. Line types operate in any position and may be serviced without disturbing pipe connections.

Write for Complete Engineering Data—Specify Oil or Water

Meets J.I.C. Standards

MARVEL ENGINEERING COMPANY
625 W. Jackson Blvd. Chicago 6, Ill.

What's NEW in Components for fluid power systems

For more information about these products use the postcard bound in this issue

PRESSURE SWITCH

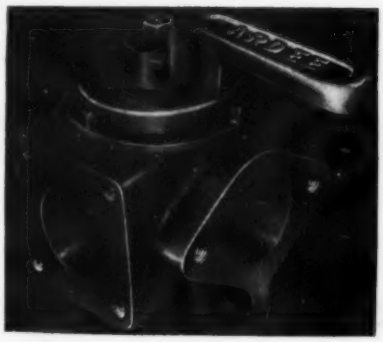
Bobrick Manufacturing Corp.
Los Angeles, California

Sizes: Operate in any one of eight different ranges varying from 125 to 7500 psi; completely adjustable within any single range.

Designation: 600 series.

Features: Designed to overcome the weaknesses of the Bourdon tube and diaphragm type of switches. The new pressure switch will operate satisfactorily between 65 deg. F. and 250 deg. F. Has a low on-off differential pressure at all times, high sensitivity, low temperature reliability, as well as durable calibration that is unaffected by high g forces, vibration, or excessive line surges and external shock.

Circle 175 on Reader Service Card



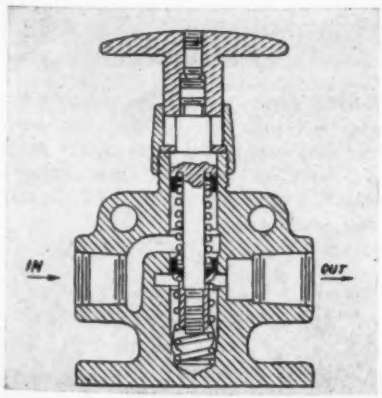
RECIRCULATING VALVE

Ardee Manufacturing Co.
Los Angeles, California

Styles: Valve is available in cast aluminum, steel or navy bronze. Bronze and steel valves are cadmium plated throughout. Flange connections are available for either male or female thread adaptation.

Construction: Combination of time proved plug valve principles and O-ring sealing. It is claimed that a positive leakproof condition is obtained and that handle loads and internal wear are reduced to a minimum by the use of an externally adjustable spring seating control featuring multiple ball pressure contact against a hardened wear ring.

Circle 176 on Reader Service Card



PILOT AIR VALVE

Rivett Lathe & Grinder, Inc.
Boston, Mass.

Designation: Series 3000.

Design: Operating the valve allows air to flow to the out port. A spring returns the valve to its original position, blocking the air supply, and bleeding the out port.

Application: For remote control of pilot pressure 4-way air valves, and can also be used for remote control of air pilot hydraulic valves. These new pilot valves can also be substituted for direct control valves in such installations where a ¼" 3-way air valve is indicated.

Styles: Six types of operation are available. The palm button, push button, and cam are offered in both side and foot mountings. The foot and solenoid types are offered only in foot mountings.

Circle 177 on Reader Service Card

For more new product information turn to page 84

The North American FJ-2 "FURY," one of the new Navy production jet fighters using H2 non-inflammable fluid in the hydraulic system.

Now all planes can have the extra safety of the Navy "Fury" with

HOLLINGSHEAD H2®

non-inflammable hydraulic fluid

Now—a hydraulic fluid that *won't burn* is available for commercial use! Originally developed to meet Navy Specification MIL-F-7083 (AER), Hollingshead H2 non-inflammable hydraulic fluid has *a flammability rating of zero.* In respect to the other qualities required to insure proper operation and long life of the hydraulic system, H2 equals or exceeds the present petroleum fluids.

Write to Hollingshead to learn how this great new product development can be successfully incorporated to improve your aircraft safety.

Check these additional advantages—

NO CONVERSION PROBLEM—It is not necessary to put off changing to H2 until airplane overhaul! No change of "O" RINGS, SEALS OR ACCUMULATOR DIAPHRAGMS is required. H2 is the only presently available non-inflammable hydraulic fluid which functions successfully with standard "O" rings conforming to Specification MIL-P-5516.

BETTER LUBRICITY—highly effective anti-wear additive increases pump life and reduces wear of all moving parts. H2's higher specific heat means better cooling of critical units through more efficient heat transfer, thus further improving service life of pumps and other components.

IMPROVED VISCOSITY—H2's higher viscosity index provides adequate viscosity at pump operating temperatures and sufficiently low viscosity even below —60° F.

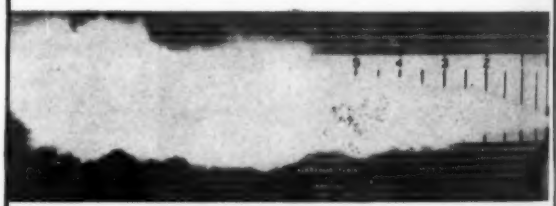
PROTECTION AGAINST CORROSION—contains additive materials to inhibit corrosion, and to deactivate certain metals to arrest galvanic action in hydraulic systems.

STABILITY—After extensive use with only normal addition of make-up fluid, there is no change in viscosity due to shear breakdown.

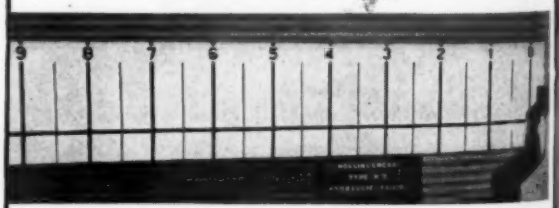
COST—H2 is the lowest cost non-inflammable fluid available today. Although it is higher in cost than the extremely inflammable petroleum fluids, the obvious advantage is more than worth the difference.

WON'T BURN

CAA tests show safety factor



10-FOOT FLAME shoots out when a regular hydraulic fluid is forced through an acetylene torch (6300° F.) under a pressure of 3000 psi.



NO FLAME results when H2 non-inflammable hydraulic fluid goes through the same test. The new fluid was assigned a flammability rating of zero by the CAA Technical Development and Evaluation Center, Indianapolis, as a result of these and other tests.

Booklet gives data

Send for a copy of this new booklet which gives a complete description of H2, including data charts and servicing information.

Industrial Division *R. M. Hollingshead* **Corporation**

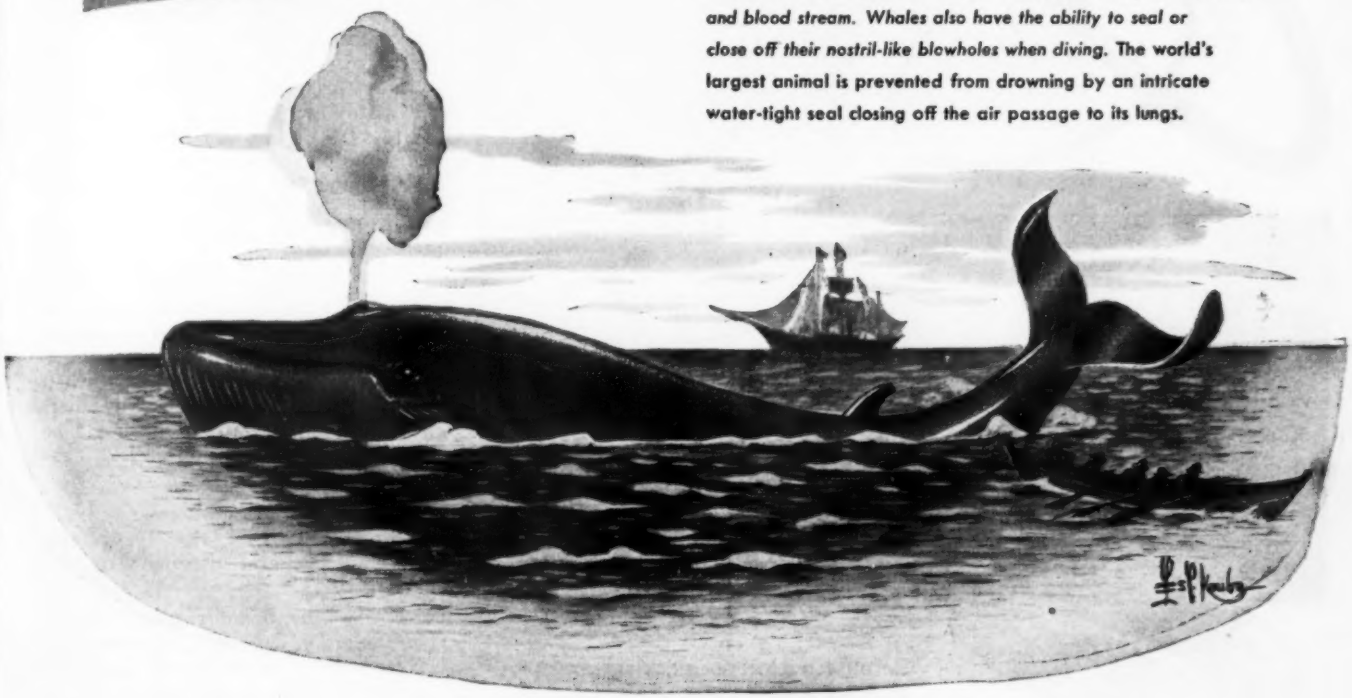
Leader in Maintenance Chemicals

840 Cooper Street, Camden 2, New Jersey

LESSONS IN HYDRAULICS

The Great Whale

Whales are the largest animals the world has ever known—larger even than dinosaurs. Blue or Sulphur-bottom whales may reach 75 or 100 ft. in length and weigh as much as 125 tons. While they look like fish and live only in the oceans, they are warm blooded, have lungs and breathe air. They are not fish but true mammals. The whale has phenomenal ability to "hold its breath" (up to an hour) while submerged. This is possible because its heartbeat and body movements slow down under water making good use of the supply of oxygen in its lungs and blood stream. Whales also have the ability to seal or close off their nostril-like blowholes when diving. The world's largest animal is prevented from drowning by an intricate water-tight seal closing off the air passage to its lungs.



NATURE'S WATER-TIGHT VALVE

The dependability and wide application of Minnesota O-Rings prove themselves in such equipment as gas valves . . . hydraulic brakes . . . compressed air equipment . . . steam or gas engines . . . lubricators . . . refrigeration machinery . . . spraying equipment. Made from special compounds of natural or synthetic rubber to satisfy specific requirements and meet rigid quality standards, *Minnesota O-Rings are the obvious answer for better packing installations in air, gas or hydraulic systems.* For prompt analysis and quotation on your requirements, send us your blue prints or specifications.

* *Bulletin available on request.*

INJECTION MOLDED MINNESOTA O-RINGS

The exclusive Minnesota injection molding process makes possible mass production economies while fulfilling extreme uniformity and tolerance requirements. Special attention is paid to O-Ring tensile strength and resistance to abrasion, compression set, hydraulic fluids, heat and cold.

Manufacturers of All Types of Small Rubber Parts

MINNESOTA RUBBER & GASKET COMPANY

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AFFILIATED WITH MINNESOTA SILICONE RUBBER CO. • OFFICES IN PRINCIPAL CITIES

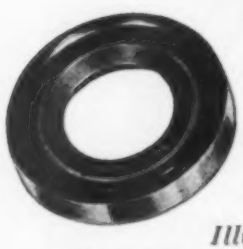
you can TRUST a TROSTEL seal

every specification is pilot-tested for *Production Quality*

Because engineered packings and oil seals often require special processing . . . Trostel designs and builds the production tools entirely within its own organization.

As soon as laboratory development is completed, Trostel engineers pilot-test the entire production operation in miniature . . . in order to ascertain the processing and tooling techniques which will retain *in production* all of the special properties and tolerances called for in the customer's specifications.

The result is a packing or oil seal that can be produced to laboratory quality standards . . . in quantities of hundreds, or hundreds of thousands.



A seal you can trust!

Illustrated Bulletin On Request

ALBERT TROSTEL PACKINGS, LTD., Lake Geneva, Wis.

Formerly Division of Albert Trostel & Sons Co., Milwaukee, Wis.

BRANCH OFFICES
NEW YORK
LOS ANGELES
SAN FRANCISCO
SEATTLE • HOUSTON
WORCESTER, MASS.

TROSTEL QUALITY

TROSTEL mechanical packings

LETTERS to the Editor

Pipe Length is a Friction Factor

In your October article "Beginners Course in Basic Pneumatics" you comment on the effect of friction in pressure drop (pages 44 and 45) without a reference to the length of path or pipe line. The tables (Figures 2 and 3) are standard tables and the values are, of course, for pounds per square inch in 1000 feet of pipe. Several copies of APPLIED HYDRAULICS are circulated within our shops and drafting rooms and serve as authoritative sources for information to our men. It is hard to convince the average pipe fitter that pressure drops have no reference to line lengths when an "authority" omits it in their tables. I believe attention should be called to this omission before confusion arises.

B. H. Southwick,
Plant Service Divisions
General Electric Co.

The factor of line lengths is treated in some detail in the November and December installments of the series. In the October installment the reader was introduced to the fact that friction is an important factor and that it is important to layout air distribution systems with a minimum pressure drop. When the three installments are read as a unit, there should be no confusion. However, you are correct that the tables referred to should have a footnote or caption defining the table values in psi per 1000 feet of pipe.
Editor's note: Mr. S. Tobey, engineer, Zallea Brothers, Wilmington, Del. also called our attention to the fact that friction losses are a function of length.

Pump Information

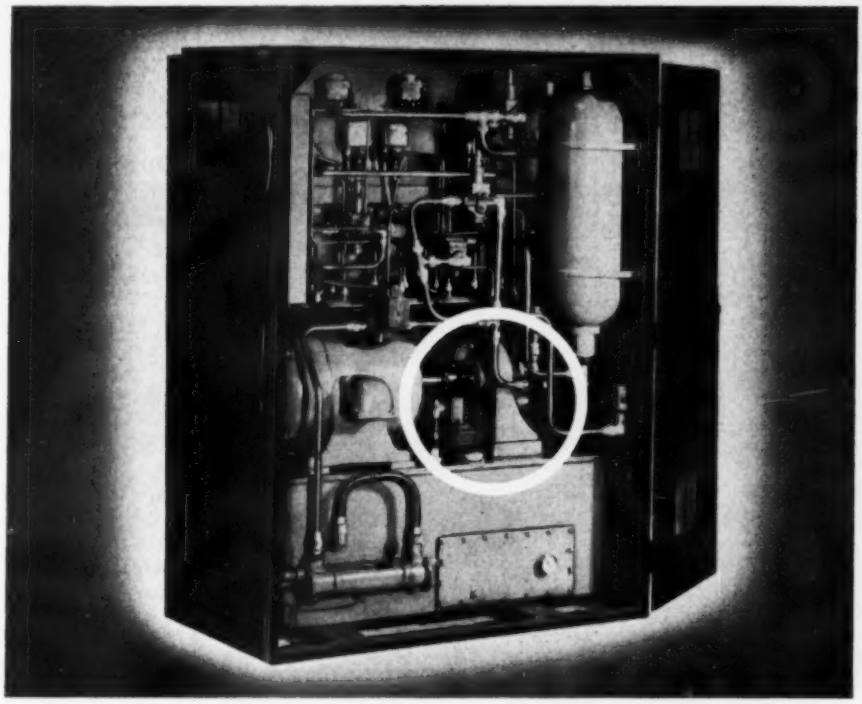
On page 38 (upper view) of the August issue of APPLIED HYDRAULICS you published a picture of a hydraulic pump in your article on the portable spike puller. Can you give us the name of the manufacturer of this pump?

Henry S. Young, Jr.
Young Enterprises

The pump shown in the illustration referred to is the Pesco pressure loaded, 3000 psi gear pump; it is manufactured by Pesco Products Company, Division of Borg-Warner

Circle 77 on Reader Service Card

WHEN IT'S HIGH PRESSURE IT'S **AMERICAN!**



Molding plastics at 3500 p.s.i. . . .

AE HYDRAMITE

FOR COMPLETE ASSURANCE of high pressure, economy and dependability the Battersby Company, Philadelphia, specialists in hydraulic design, has specified the RCD-3 Hydramite for this automatic molding machine. More and more machine manufacturers are continually adopting Hydramite. This rugged radial multi-piston, constant displacement, oil-operated pressure generator maintains pressures up to 5000 p.s.i. and is bringing new efficiency to a wide range of hydraulically-operated equipment.

Hydramite has an overall efficiency of 85% without supercharging. It is direct driven through a flexible coupling . . . rotates in either direction, can be foot, flange or face mounted . . . comes in 3, 5, and 10 g.p.m. oil capacities.

Your American Engineering representative is fully qualified to analyze your hydraulic requirements and to engineer and install the proper power units. He also assumes responsibility *locally* for efficient, uninterrupted service.

Mail coupon now for complete information.

HELE-SHAW
variable pressures up to 3000 p.s.i.

Hele-Shaw is a radial-piston variable displacement fluid power generator. Pressure and reversal of flow are controlled directly at the pump. Discharge can be varied from zero to maximum. Capacities from 0.5 to 53 g.p.m. and up.

AMERICAN ENGINEERING
COMPANY
PHILADELPHIA 25, PENNA.

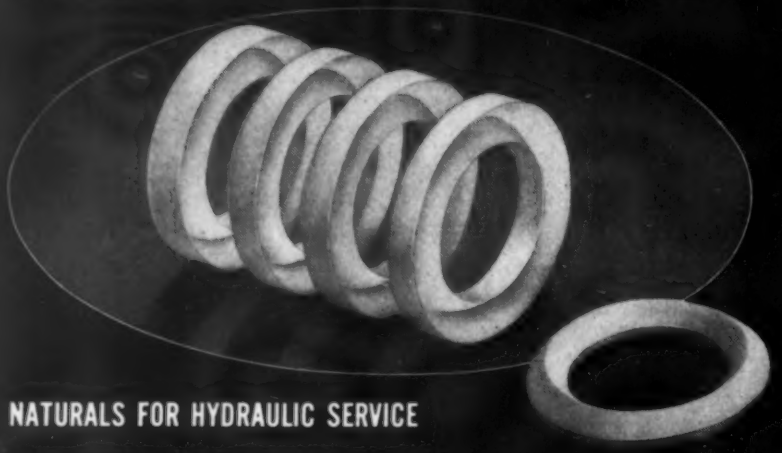
AE Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers.

American Engineering Company
2530 Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: Kindly send me complete information about the
☐ Hydramite. ☐ Hele-Shaw Pump.

Name.....Title.....
Company.....
Address.....
City.....Zone.....State.....

CHEMISEAL (MADE OF TEFLON) PACKINGS



NATURALS FOR HYDRAULIC SERVICE

Unaffected by any hydraulic fluid, Chemiseal Packings—made of chemically inert Teflon*—won't harden, soften, swell or shrink in service. Outlast other type packings several times over.

FOR HYDRAULIC VALVES

Try Chemiseal V-Type Packings that seal with low gland pressures and operating torque. Extremely resilient, tough, antihesive—it cannot seize the valve stem, is ideal for either manual or automatically operated valves.

Supplied in sets with square-end Teflon adaptors. Ask for Catalog No. 810-V.

CHEMISEAL BACK-UP RINGS

Protect O-Rings and other packing from extrusion, deterioration and loss of efficiency with Chemiseal Back-up Rings.

They support packing and greatly lengthen its life.

OTHER CHEMISEAL PACKINGS

U-Rings | Cup Packing | Flange Packing

UNITED STATES GASKET COMPANY

FLUOROCARBON PRODUCTS DIVISION

FABRICATORS OF "TEFLON", "KEL-F" AND OTHER FLUOROCARBON PLASTICS

CAMDEN 1, NEW JERSEY

*du Pont's trademark for its tetrafluoroethylene resin.

Letters to the Editor

Continued

Corporation, 24700 North Miles Road, Bedford, Ohio.

Quick Shut-off Hose Valve

We have some additional information regarding a valve for opening and closing a hose by kinking or flexing the hose tip. This question was asked by Wright K. Gannett in this column (July issue, page 12). One answer (October issue, pages 26 and 28) has already been published. The "Flex Nozzle", offered by Wilkerson Corporation, 1749 South Broadway, Denver, Colo., in ¼ and ½ inch sizes, is operated by flexing the hose tip. The entire pressure is on the valve assembly until the flexible section is flexed, forcing the valve assembly against the valve seat, forming a perfect seal. Any desired amount of air can be released.

More About Nomenclature

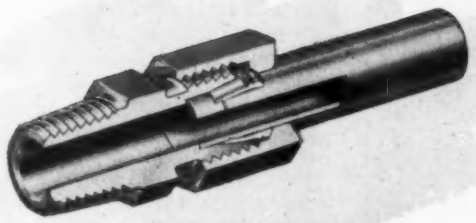
We believe it would be of value to the pneumatic and hydraulic trade to have better terms to refer to certain types of valves. As you know, one of our worst misnomers is the word "master" as applied to valves. In the hydraulic field, because of the firm delineation of the slave valve, the "pilot valve" is often referred to as the "master valve"; while in the pneumatic field, going back many years, the term "master" has been used to designate the valve corresponding to the hydraulic slave valve, with the pilot remaining as a pilot valve. In all fairness to both fields, it might be advisable to encourage some other terminology to denote this type of valve and discourage the use of the term "master" valve. In addition to this confusing terminology, there are quite a number of valves which have come into use over the last few years for which there is no good, convenient and universal identification. For this reason, we feel that is would be a good idea to encourage an interplay of terminology from the various manufacturers and customers to inject or possibly create terms which would be suitable for all to use.

In this connection, we are suggesting a couple of terms which we believe would be universally useful. We would like to see others join us in the general use of this or some other terminology which could be agreed upon. We suggest, as examples, the following terms and definitions:

WANT HYDRAULIC CONNECTIONS-FAST?

Specify these Weatherheads

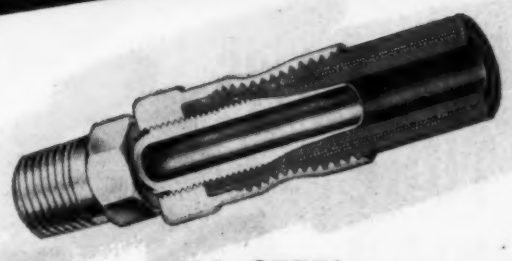
TIME-SAVING TWINS



ERMETO®

Saves up to 60% of installation time on steel tubing installations—up to 40% on copper and aluminum. You can make tube connections at all pressures with only a wrench—no special tools required.

Quick! Safe! Economical!



ALL-STEEL

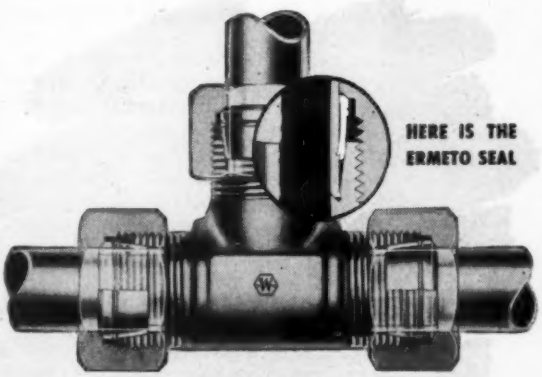
REUSABLE HOSE ENDS

AND INDUSTRIAL HOSE

Permit quick make-up of flexible lines from stock. Any length—whether low pressure or high—installation of hose assemblies with REUSABLE hose ends is quick and easy with ordinary bench tools.

Saves time—saves inventory.

HERE'S HOW ERMETO WORKS



No flaring, no threading, no welding, no soldering! Ermeto nut presses sleeve as threads engage. The forces acting on the sleeve cause it to bow slightly and actually bite into the surface of the tube. This strengthens the seal (see enlarged section, above), distributes vibration strains and holds a constant tension between the body and nut, to prevent loosening. Disassembly and retightening are easy—the sleeve remains in place, assuring a pressure-tight joint. Ermeto fittings meet J. I. C. requirements.

ASK FOR FULL INFORMATION

ERMETO—catalog No. E-1457A contains complete details on all sizes available in steel and stainless steel.

REUSABLE HOSE ENDS AND HOSE—catalog No. H-1451A lists complete range of hose sizes and pressures available for use in general industry.

Address: Dept. A, THE WEATHERHEAD COMPANY, 300 East 131st Street, Cleveland 8, Ohio. In Canada, THE WEATHERHEAD COMPANY OF CANADA, LTD., St. Thomas, Ont.

Weatherhead Industrial Warehouse Distributors in all principal cities.

The Mark of Quality

WEATHERHEAD

***FIRST* IN HYDRAULIC CONNECTIONS**

SAVE TIME, WEIGHT & SPACE!

Roylyn 1900 Series TUBE UNION

The Roylyn 1900 Series Tube Union is a compact and light-weight tubing connection employing the Army-Navy flared tube type of sealing. Where a union between two lines is required, the Roylyn Union, with a single thread joint, affords maximum efficiency with between 30% to 60% weight saving over comparable tube unions and effects important space saving in all sizes.

TIME
Quickly installed with fewer, simpler and less expensive tools.

WEIGHT
30 to 60% weight saving over comparable tube unions.

SPACE
Compactly designed with a single-thread joint for maximum efficiency and minimum space requirements.

ROYLYN PRODUCTS

QUICK COUPLINGS
A complete range of types, sizes and materials for every requirement.

OXYGEN VALVES
Conform to and exceed all requirements of SPEC. MIL-V-5027.

HOSE-COUPLING ASSEMBLIES . . . Standard AN components are combined with either open or self-sealing Roylyn Quick Couplings.

FILLER-UNIT ASSEMBLIES
. . . Lightweight and built for rough service to meet every requirement.

ROYLON SPIRAL BACKUP RINGS

. . . A Teflon ring with low friction, long life and higher operating efficiency.

SPECIAL VALVES
A typical example of specialized equipment is this Tank Pressure Regulating Valve.

Roylyn

ROYLYN, INCORPORATED
1706 Standard Ave., Glendale 1, Calif.
QUICK COUPLINGS • VALVES & COUPLING VALVES
FILLER UNIT ASSEMBLIES • TUBE UNIONS • WEG INSERTS • KINMONT POWER UNITS

Write for Folder HR-191

Letters to the Editor

Continued

RETROLD - An adjective used to describe a remote controlled valve which is air, oil or water controlled, i.e., a fluid piped to the valve is the source of actuation and de-actuation of the valve; or, stated in another way, the valve reacts directly in relation to the pressurizing and exhausting of the fluid control system connected to it.

INTROLD - An adjective used to describe a valve which has a built-in pilot of some nature. There is no attempt in this word to define the means of actuation, which could be solenoid, hand, foot, cam, etc.; the term would simply mean that a piloting mechanism, which would be an intermediate part of the valve unit between the actuating force and the main operating valve proper would be integral in the process of the valve action. Actuating the pilot mechanism directs fluid to operate the main valve mechanism. We suggest this word as a contraction of "intermediate controlled" or "internally controlled". It is a built-in pilot controlled valve.

R. J. Cameron
Ross Operating Valve Co.

We thoroughly agree that a real need exists for general agreement on valve nomenclature. We invite further comments, especially from valve manufacturers and from users of both hydraulic and pneumatic valves.

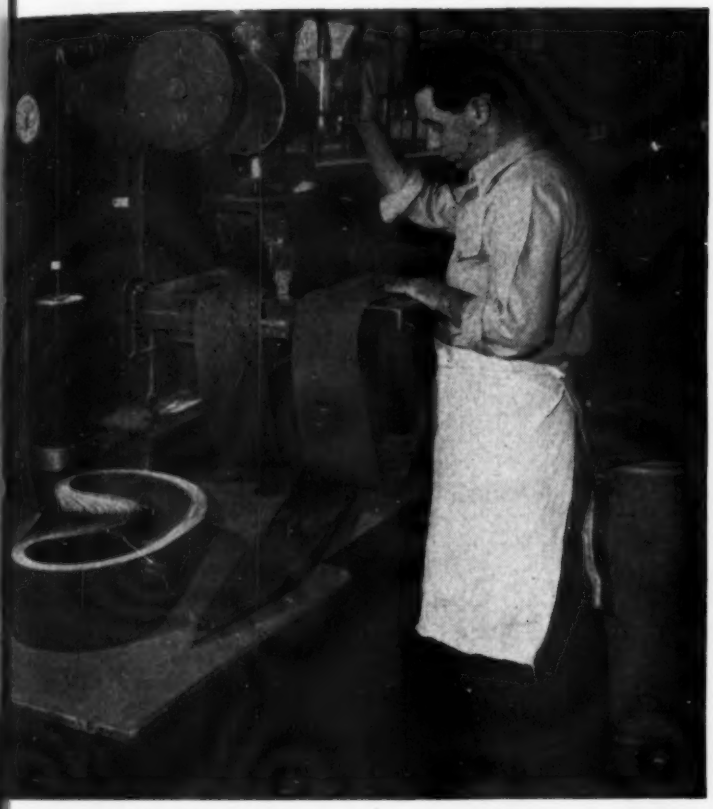
A Question of Terminology

I was interested to see the article "Air Powered, Oil Controlled Cylinders" which appears on pages 46-47 in your October issue. May I suggest that in the legend for the figure on page 47 that the designation of the hydraulic circuit should be "self contained hydraulic regulating circuit" instead of " . . . . operating circuit". The diagram is that of the Logansport Air-Draulic cylinder, in which air is the operating means; the hydraulic circuit serves no other function except regulation.

H. E. Bechler,
Cramer-Krasselt Co.

You are correct that "regulating is a more accurate description than "operating" in describing the hydraulic circuit. Unfortunately, no standardization of nomenclature has as yet been attempted for either hydraulic or pneumatic system components with the result that the same name may mean several things to several different persons or the same function may be described by several different terms.

SERIOUS PRODUCTION LOSS STOPPED BY SWITCH TO SUNVIS H.D. 700 OILS



VARNISH NO OBSTACLE—This is one of the many presses of various sizes which form joints in abrasive sanding belts for production use in the automobile, jet engine and woodworking industries, as well as many others. Six years ago equipment like this press needed costly maintenance at frequent intervals because of varnish formation. Then a Sunvis H.D. 700 Oil was adopted as the hydraulic medium, and the trouble disappeared like magic.

NO OIL CHANGE—This large press is used for joining abrasive belts used in polishing stainless steel. Although the oil temperature at which it operates is 130 F, the 200-gallon charge of Sunvis H.D. 700 is still in excellent condition after nearly four years' use.

Among the 30,000 types of abrasive specialties made by Behr-Manning Corporation, Troy, N.Y., Division of Norton Company, are sanding belts requiring smooth, uniform joints. Dozens of hydraulic presses, ranging in capacity from 5 to 150 tons, form the joints to the same thickness as the belts.

The hydraulic oil in use six years ago created a production obstacle by forming varnish in the pumps and valves. At least once a year the systems had to be overhauled and the pumps sent to the manufacturer for repairs, with consequent production loss.

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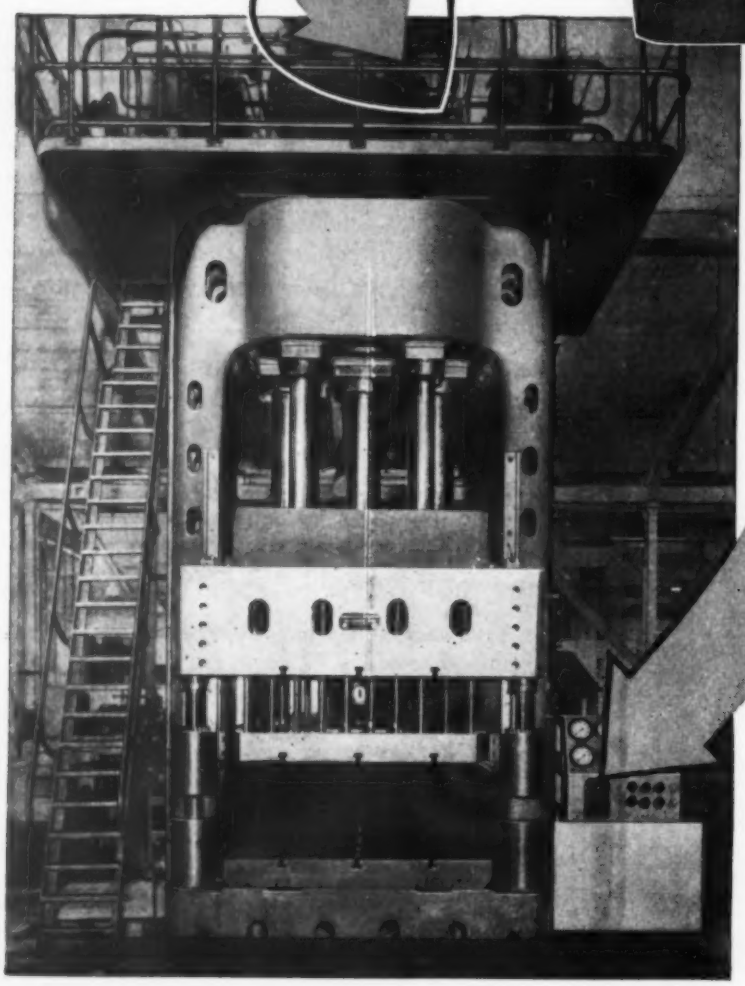

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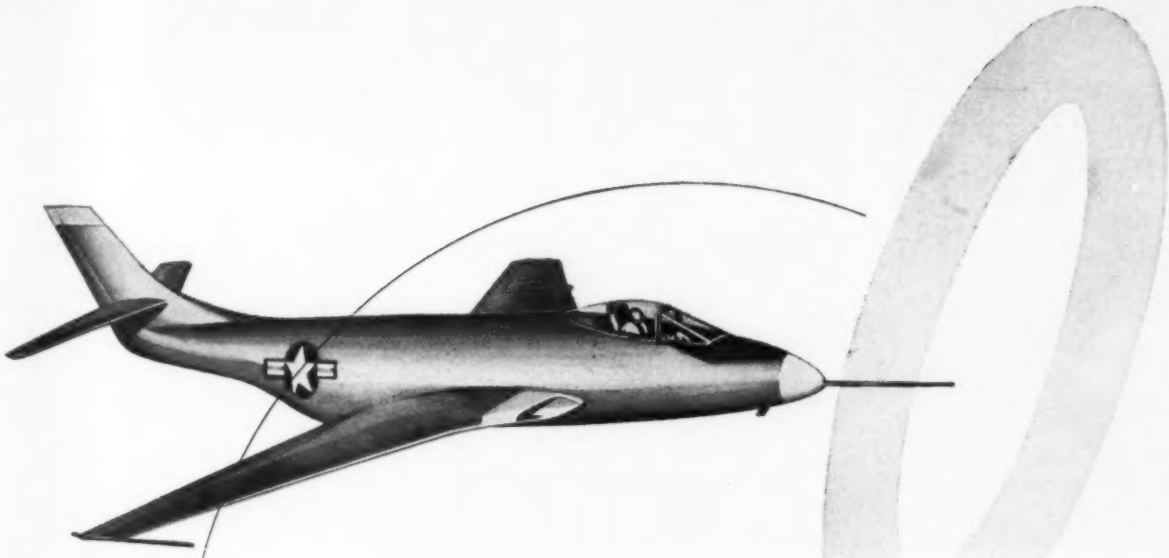

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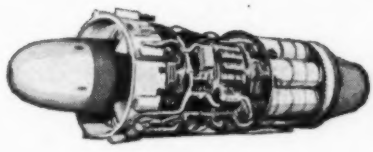

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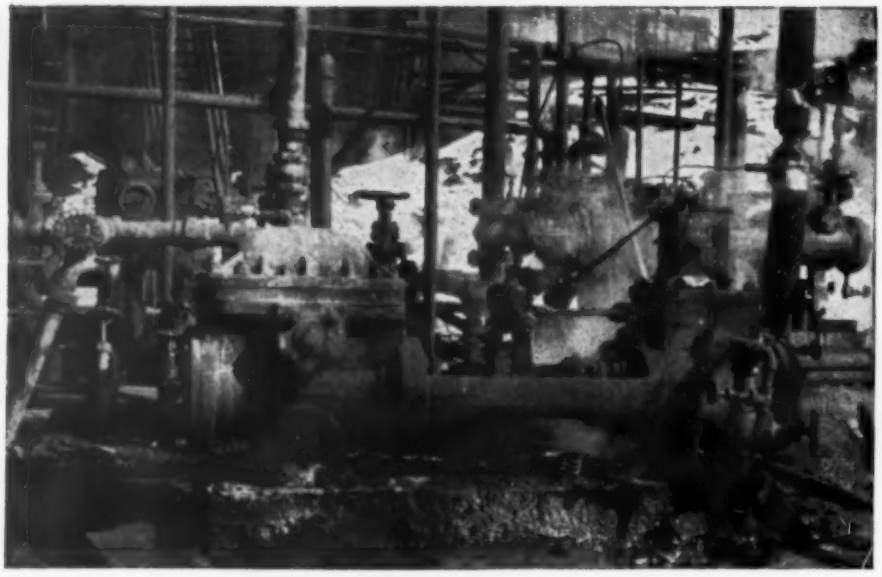

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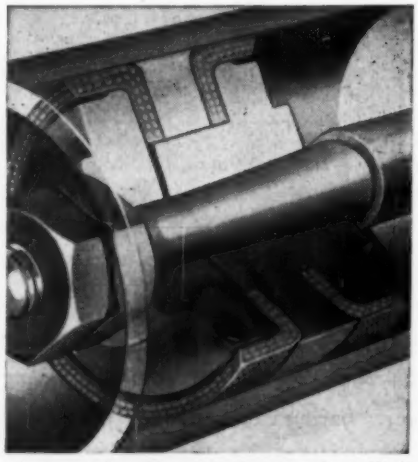

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British Industries Fair Set For Spring 1953

MORE buyers from America than ever before are expected to attend the British Industries Fair in 1953. The 1953 Fair will open on April 27th next year, running through May 8th. As in former years exhibits will be contained in three huge halls, Castle Bromwich in Birmingham, and Earl's Court and Olympia in London. Earth moving machinery and other outdoor heavy machinery will be displayed alongside the Castle Bromwich exhibit hall as in previous years.

Last year there was a record attendance of American buyers. Expectations this year are that the number may be even larger in view of the merchandise offerings to be revealed at the Fair, and the increased number of visitors to England due to the Coronation which comes a few weeks later.

Exhibits by approximately 2,500 British manufacturers are expected for this year's two week Fair, and buyers from a hundred countries are expected to be in attendance. The Fair is operated exclusively for buyers except on a few hours each week when workers in factories producing goods for export and other non-buyer visitors are admitted. Special train service between London and Birmingham will be provided as in previous years. Clubs for overseas buyers, interpreters and secretarial services will be available in all three buildings.

ASM Establishes Foundation for Education and Research

Recognizing the grave shortage of engineering students in the United States and the urgent importance of metals research to the security of the free world, the 22,000 members of the American Society for Metals have established a Foundation for Education and Research.

Initial assets of the Foundation, amounting to $650,000, will provide a yearly income of approximately $30,000 to be used for the advancement and dissemination of scientific knowledge, particularly with respect to the technology of metals.

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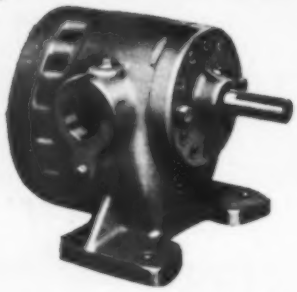

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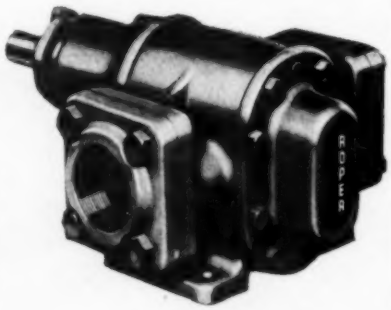

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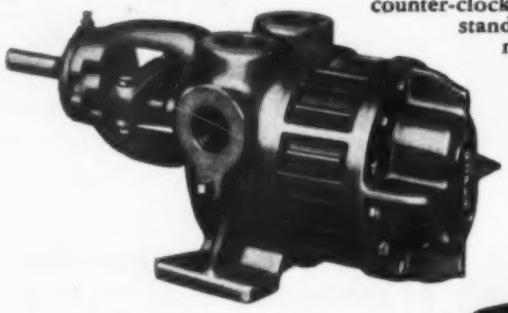

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Compressed Air Gas Institute Receives ATAE Award of Merit

ONE of the nation's highest honors recognizing the value of trade association services has been awarded Compressed Air and Gas Institute, the trade association of manufacturers of industrial air and gas compressors and compressed air powered tools and rock drills used in industry.

The honor referred to is the Award of Merit presented to the Institute in the 1952 ATAE Awards for Distinguished Service sponsored by American Trade Association Executives of Washington, D. C.

The Institute's award-winning public relations program was launched in 1941 and has consisted of approximately 50 case history articles published annually in leading trade journals, the publication of "Compressed Air Handbook" in 1947 and a series of engineering teaching aids. The continuing program is developed by two committees of the Institute in collaboration with Edmond C. Powers director of public relations of The Griswold-Eshelman Co. of Cleveland, who has served as Educational Director of the Institute since 1941.

Rheem Opens Research and Development Laboratory

THE entire activity of Rheem's research and development laboratory, Whittier, California, will be concentrated on research and development work for the Rheem Aircraft Division Plants in nearby Downey, California.

Rheem's research center, covering 34,000 square feet was built during 1951 at a cost of $750,000. Chemical metallurgical, environmental, strength and fatgue testing equipment has been installed throughout the laboratory.

Staff of the engineering design and research department has been increased to carry out the new program. Laurance A. Cooper, general manager of the Rheem Aircraft Division, also heads the research and development program. He has recently appointed Robert E. Root as chief engineer, in charge of research and design projects. Root was formerly associated with Northrop Aircraft.

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Conversion From Steam to OIL POWER for steering tug boats

By Robert C. Ryan and Elmer F. Heiser

THE Great Lakes Towing Company, operators of a sizeable fleet of tugs, recently embarked on a steam to diesel conversion program. The change involves the installation of engine, propulsion gear, new propellor and electrical equipment. An oil hydraulic system was developed to replace the steam steering gear.

All of the company's steam tugs were equipped with an old but relatively efficient Dunham type steam operated steering gear. It consists of a large diameter steam cylinder with a piston rod extending from each end to which steering chains are attached. A small diameter oil hydraulic dash pot cylinder is connected parallel to the steam cylinder to limit the speed of movement.

ROBERT C. RYAN, Fleet Engineer, The Great Lakes Towing Co., Cleveland Ohio.

ELMER F. HEISER, S. G. Morris Co., Cleveland, Ohio.

A rotary type steam valve is used to control the direction of steam flow to the gear. This valve is controlled by a centering linkage mechanism which permits shifting from the pilot house and recentering from the steering cylinder. The large steering cylinder is installed below decks, forward of the engine room and is connected to the rudder by means of a complete "loop" of chains and pull rods.

Two characteristics of the steam gears were very desirable and it was decided that, insofar as possible, they should be retained in the steering system after conversion. One of these features was the vertical lever in the pilot house which both controlled steering and also indicated the rudder position. The other feature was the speed of operation. Marine practice over the years has established and accepted a rudder operating speed of from 12 to 20 seconds for a complete rudder swing (hard-over port to hard-over starboard),

Changeover of a fleet of tugboats from steam to diesel power required the design of a new oil driven steering gear

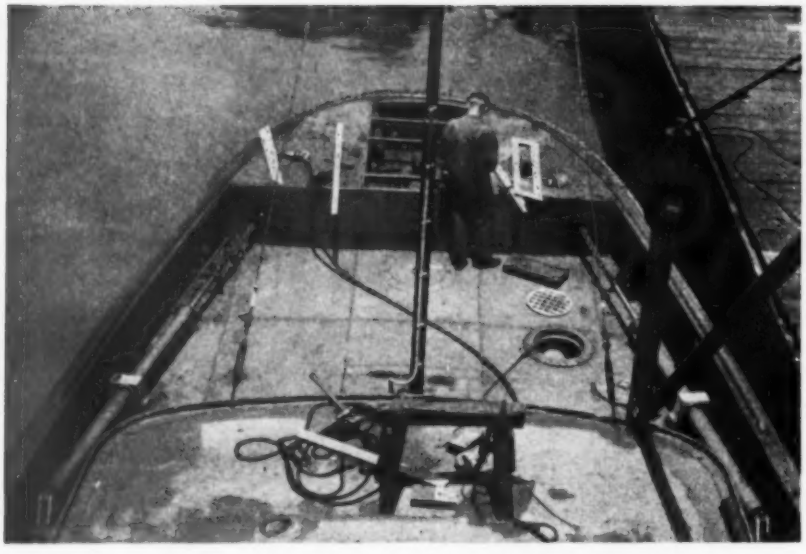


Fig. 1. Hydraulic, single acting steering cylinders, having 38 inch stroke and 5 inch bore, have been installed on deck in the stern of this tug. Smooth sheet metal enclosures will cover the cylinders to prevent fouling of lines while towing. A chain links the cylinders to the steering quadrant.

Fig. 2. This steering lever in the pilot house controls the movement of the directional valve spool. It is also tied through indicator cables to the port steering cylinder. Movement of the steering cylinder results in proportional movement of the steering lever to tell the pilot the position of the rudder.

operators of Great Lakes tugs have been accustomed to rudder turning time of about 3 seconds. When specifications were made, the vertical lever with steering control and rudder indication and a H.O. to H.O. time approaching 6 seconds were included.

It was also desirable to reduce the steering mechanism to a simplicity which would allow for any required maintenance with limited port facilities and without the need of "special" parts or equipment. It was also necessary that the installation of the new gear would not require any major structural changes in the ship.

An oil hydraulic system was developed which meets the original requirements and has proven simple to install and easy to maintain.

Hydraulic Cylinder Design

Without disturbing the existing after-end as shown in Figure 6, a cylinder was installed along each side of the deck, Figure 1. A short length of chain connects each deck cylinder to the chain quadrant on the rudder stock. The deck cylinders are housed to present an even, unbroken surface for the handling of lines while towing. Protection against dust, water, silt and ice is also provided. Figure 5 shows the cylinder design. A protective housing with a "loose" stuffing box and an ice breaker is included. The portion of the piston rod which passes through the cylinder extends beyond the outer "loose" stuffing box. The "double" extension has an advantage in addition to providing protection for the sealing surface in that it allows for some limited flexibility of the rod to follow chain and sheave variables.

The compact oil power unit and control valves are mounted below the deck in the stern of the boat, Figure 3. A 7½ hp, 120 volt d.c. motor drives a variable volume vane type pump by means of a flexible coupling. Both motor and pump are mounted on a 55 gallon tank which is the sump and storage tank for the hydraulic oil.

Use of a pressure compensated variable volume pump results in a very efficient system. Pump volume decreases as turning torque increases. Curves in Figure 8 show the volume, torque and power relationship. With a maximum pressure setting of 600 psi, the power demand of the pump is normally below the electric motor rating of 7½ hp.

Agreement between rudder position and steering lever position in the pilot house, Figure 2, is accomplished by means of an indicator cable which runs from the port cylinder to the lever. The steering lever consists of the lever itself or control stick, the steering lever banjo, the steering lever support plate and control slider fork and bar. The control stick and banjo although an integral assembly, are separately operated. The control stick has a net movement of two inches at the slider fork and bar and is actuated by the operator while the banjo follows the rudder movement and is actuated by the indicator cable.

The steering control unit consists of a 4-way valve which is spring centered by a spring cage, a valve block and the mounting plate.

When the 4-way valve is in the center position, the 1¼ inch lines leading to the rams are blocked, locking the rams in position. Oil from the pump is directed through the 4-way valve back to tank. The spring cage

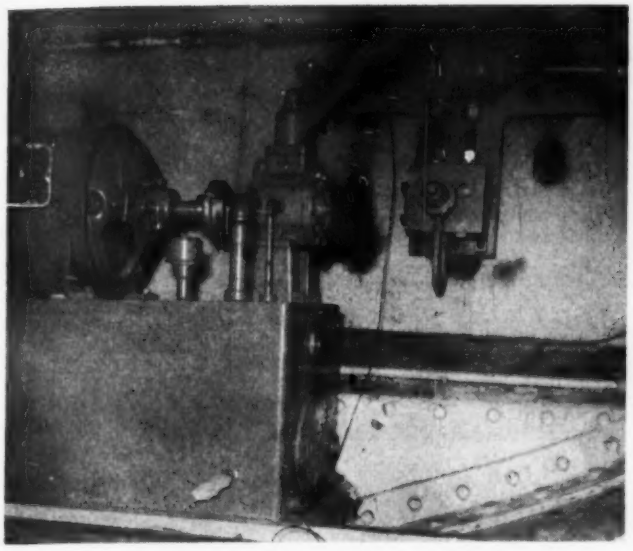


Fig. 3. The hydraulic power system is mounted below decks in the stern of the tug. On the left end of the directional valve spool, you can see the control cable wrapped around the sheave. Mounted on the right end of the spool is the valve centering spring cage. Incorporated in the one valve block seen below the directional valve are check, relief, by-pass and flow control valves.

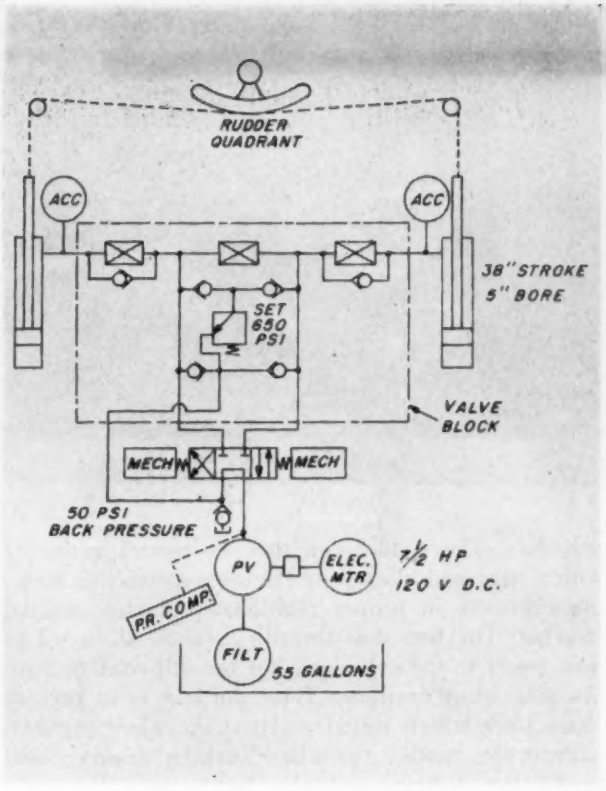


Fig. 4. Schematic of the hydraulic steering system shows the simplicity of the circuit. In the event of excessive external forces, the check valve arrangement will prevent the rudder from being irresistibly locked between closed oil columns.

is adjusted so that the valve returns to dead center when released from either direction. When the 4-way valve is directed one way or the other, the pressure is connected to the proper cylinder and the line of the opposite cylinder is opened to drain into the tank.

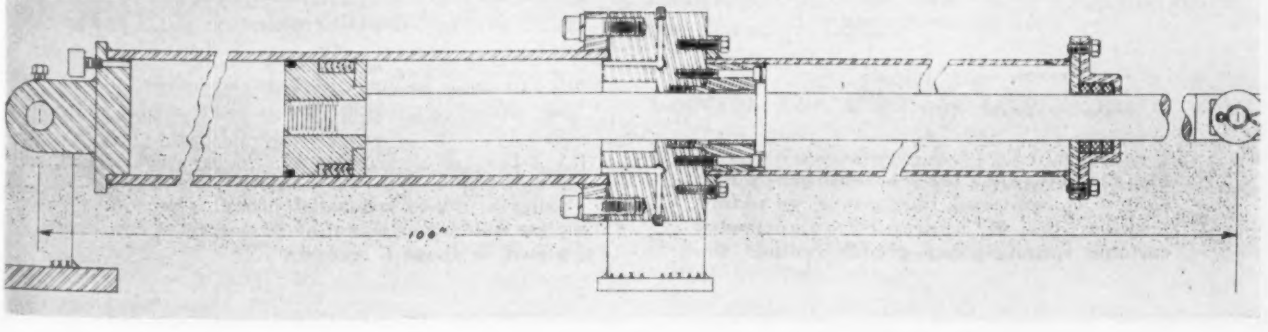
Rudder Control Without Chain Slack

The valve ports are made so that maximum throttling control is obtained. When the valve is shifted off neutral a short distance, pressure from the pump connects to one cylinder. Continued movement of the valve spool opens the other cylinder to drain through a long throttling travel. Thus complete rudder control is obtained without chain slack due to the fact that the pulling cylinder is always governed by the rate of drain from the opposite cylinder. Not only does this arrangement give the helmsman an absolute "feel" of the rudder, it minimizes the shocks usually associated with a chain type steering mechanism.

A valve block is used which contains four check valves, a relief valve, a by-pass valve and two free flow throttling valves. The check valves and relief valve act as a unit to by-pass oil from one cylinder to the other when cylinder pressure, resulting from an external force on the rudder (the rudder being backed into a dock for example), builds up beyond 650 psi, the pressure for which the relief valve is set.

If there should be a power failure, the by-pass valve in the block can be opened to cross-connect the

Fig. 5. Cylinder cross-section shows the rod protection provided against water, silt and ice. The portion of the piston rod which passes through the cylinder rod bearing and pressure seal never extends beyond the outer stuffing box.



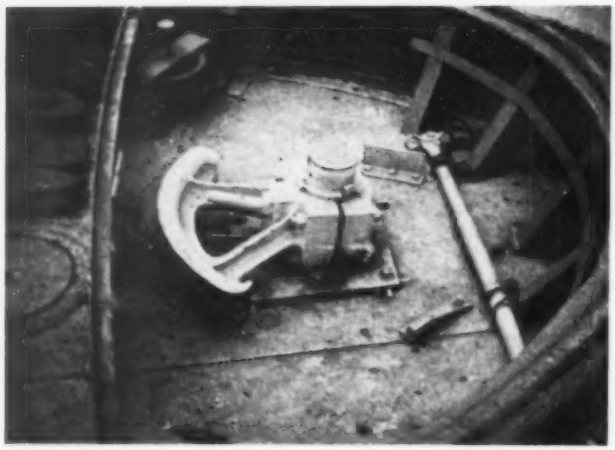
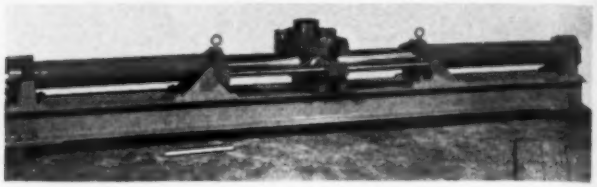


Fig. 6. Original steering quadrant in the stern is used in the conversion. The quadrant is rotated by the action of two single acting hydraulic cylinders acting in tension on chains.

Fig. 7. When sufficient space is available in the stern of the boat, this compact completely protected rapson slide steering cylinder arrangement replaces the quadrant and chain system.



cylinders. The rudder can then be moved manually with a tiller and blocks and the cross-connection keeps the cylinders in proper relationship during manual steering. The free flow throttling valves allow oil to flow freely to the cylinders, but are adjusted to limit the flow when draining. Their purpose is to prevent chain slack which would result if the water pressure against the rudder (as when backing down) could "pull" the draining cylinder faster than the pump can supply the opposite cylinder.

The cylinder ports are blocked when the valve is in neutral; therefore, any leakage in either cylinder or any stretch or wear in the chain would immediately result in lost motion or slack between the rudder and the steering cylinders. The constant 50 psi backpressure enters the system between check valves as shown on the diagram. Should any lost motion develop low pressure oil enters the cylinder, to "hitch up" the slack. The low pressure is trapped by the check valves.

A 10 cc accumulator, precharged to 250 psi, is mounted on each cylinder to assist in preventing extreme stresses due to shock loading.

The use of the valve block to replace separately piped components greatly reduces leakage and damage caused by vibration.

To insure successful operation of the steering gear, a careful maintenance program has been worked out. Keeping the system clean is emphasized. Leaks are promptly corrected and tubing runs are kept free from rust.

Comparing Power Requirements

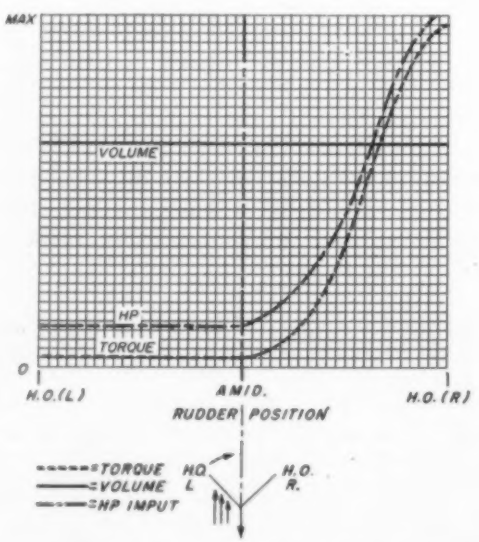
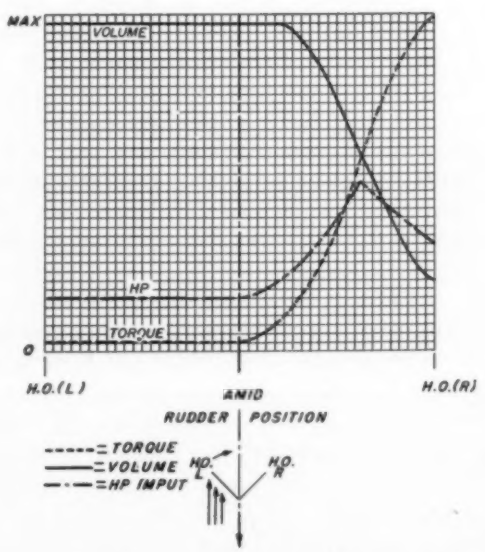


Fig. 8. Curves show the relationship of pump volume, torque and horsepower to rudder position. Use of a pressure compensated variable volume pump greatly reduces the power requirement as compared to a system using a non-compensated pump. The complete rudder movement of 90 degrees is completed in about 6 seconds.



How do you manually operate a valve which is located out of the operator's reach? A fluid system which can be taken around corners offers an efficient solution. It is possible to obtain simple, accurate control needed for continuous high speed operation.

REMOTE CONTROLS for oil powered charging machines

By Oscar Bieshelt

IN the design of a charging machine or forging manipulator, we must use a system of manual control to obtain positive motions during a short interval of time.

The billet charging machine shown in the forge shop of the Cameron Iron Works, Inc., Houston, Texas takes cold steel billets weighing up to 3000 pounds from the floor, or storage piles and charges them into furnaces. On being heated to 2300-2450° F, the billets are taken out of the furnace and carried over to the 5000 ton hydraulic press and dropped into the die cavity. The press produces forgings which are used in the oil field and refinery industries.

This machine also removes the finished forging from the press. Changing press dies is speeded with the assistance of the charging machine. The production of this layout can average around 60 to 120 pieces per hour depending on weight and character of the work.

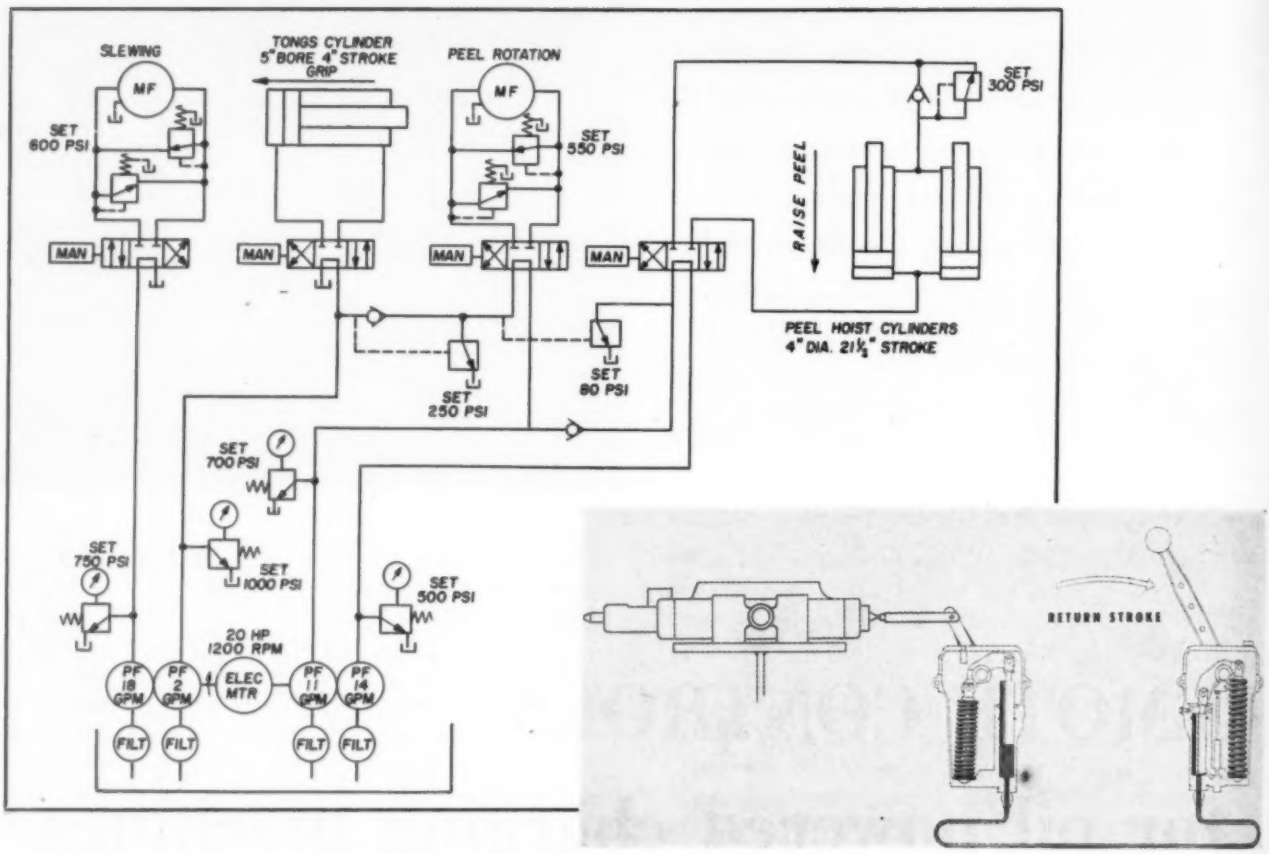
The charging machine operator has to control two electric and four hydraulic motions in addition to open and close the furnace doors and operate a descaler which removes scale from the heated billets. For the charging machine shown here, the numerous motions and functions to be controlled by the operator are charted in Table 1.

Control For Multiple Operations

Direct manual control has proven superior to other control due to its flexibility. Should it be necessary to operate any of the charging machine motions by very small increments, it is possible to do so with manual control.

The upper trolley assembly on which the operator

OSCAR BIESHELT, President, Columbiana Engineering Company, Columbiana, Ohio.



Each of the four manual control valves on the charging machine's hydraulic system are controlled remotely by a single tube hydraulic transmitter receiver system. The hydraulic remote controller is used for a four-way valve having a valve spool stroke long enough to permit using a direct connection link mechanism to the receiver. When the valve stroke is short a multiplying linkage is used to give the desired travel.

sits and consisting of the peel* with attached tongs is divided so that electrical controls are on one side while the hydraulic valving and sequencing mechanism is on the other.

Considerable space for the valve mounting and necessary piping would be used if lever operated hydraulic four-way valves are positioned around the operator. Also, if the electrical controllers are mounted around the operator, his hands would be moving in all directions sometimes in awkward fashion. To simplify the operating system, each valve is remotely operated through a single tube hydraulic receiver and transmitter. For the motions using electric motors for the motive power, a chain drive mechanism connecting the operator's lever with the face-plate controller is used.

Operation of Valve Controller

This remote hydraulic control consists of a transmitter and receiver connected by a single tube. Cylinder, piston assembly, and spring assembly of the receiver are identical to those of the transmitter. The receiver has no oil reservoir and therefore no valve assembly. The transmitter is positioned in front of the operator and the receiver is connected to the hydraulic four-way valve.

Here is how the remote control operates. Opposing springs of equal force in the transmitter and receiver "balance" the control and eliminate lost motion and backlash. Fluid pressure in the system approximates 200 psi. On the pressure stroke, movement of the transmitter handle to the left forces its piston downward displacing hydraulic fluid from the transmitter cylinder through the connecting tube and into the receiver cylinder, forcing the receiver piston upward and simultaneously moving the receiver lever the same number of degrees as the transmitter handle. On the return stroke, the transmitter spring is compressed and the hydraulic fluid (now under pressure of the receiver springs) is returned from the receiver cylinder to the transmitter cylinder, moving the receiver lever the same number of degrees as the transmitter handle.

A unique synchronization feature is employed to compensate for any temperature variation resulting in volumetric changes of fluid between pistons, and loss of synchronization. Any change in fluid volume can be compensated for easily and instantly. Moving

**Where did the term "peel" come from? Webster defines a "peel" as a shovel used by a baker for reaching into an oven.*

the transmitter handle through its 7 degree overtravel position, operates the tripper lever and opens the valve, releasing fluid from reservoir into the system, or permitting the return of excess fluid to the reservoir.

Among the advantages of remote control are:

a. Design of machinery is simplified and compact
b. Amount of hydraulic piping is considerably reduced
c. Operator has control over the numerous motions directly within reach
d. There are no obstructions to operator visibility
e. Motion approaching servo control is obtained.

Hydraulic Circuit Design

As shown on the schematic diagram of the hydraulic system used on the billet charging machine built by Columbiana Engineering Company, both fluid motors used for slewing and peel rotation are balanced gear type units having a displacement of 3.76 cubic inches per rev and developing 60 inch pounds of torque per 100 psi oil pressure. Both fluid motors have their output shaft speeds reduced through a 22.2 to 1 ratio planetary gear reducer. This speed is further reduced by a 11.5 to 1 ratio gear drive to obtain 4.23 rpm speed for the slewing motion, and by a 3.94 to 1 ratio gear drive to obtain 17.4 rpm maximum for the peel rotation.

Using four pumps, each of the four operations can be operated independently. However, to speed the operation by combining pump volumes, tongs cylinder, peel motor and hoist cylinders have their control valves connected in series.

The hoist cylinders raise the peel when pressure is

. . . white hot billets weighing up to 3000 pounds are brought to the press by remotely controlled tongs . . .

applied to the rod end of the cylinders. The mechanism connecting the cylinders to the peel is a simple first class lever with the fulcrum between the load and the cylinder mounted underneath the lever.

The counterbalance valve set at 300 psi in the hoist circuit prevents the loaded peel from dropping when its four-way valve is shifted across center between raising and lowering positions of the valve speed.

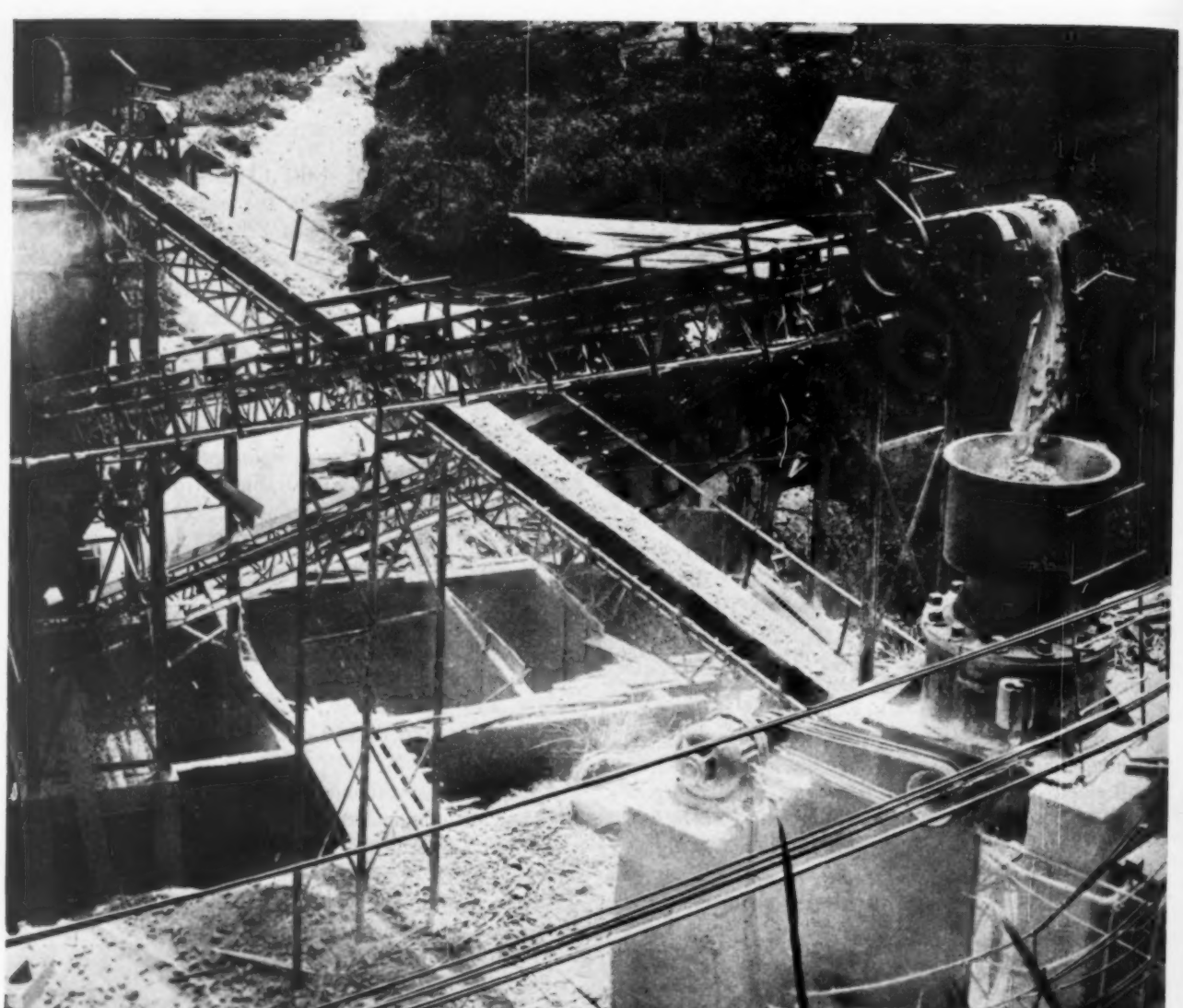
All valves when in neutral are open to tank except the tongs valve which is closed center. The 2 gpm pump supplying the tongs cylinder is unloaded by a relief valve set at 1000 psi. Fluid from peel rotation pump is unloaded by unloading valve set at 250 psi. The unloading valve set at 80 psi dumps when hoist pump discharge is not required to supplement the peel rotation pump.

Two sequence valves are used in the fluid motor circuits to act as a relief and replenishing valve unit, protecting both lines between a blocked port four-way valve and fluid motor. They function as adjustable acceleration and deceleration devices as used in braking and stopping.

The 250 psi unloading valve is set at this figure to provide sufficient starting torque to get the tongs to open or close quickly. The tongs four-way valve, being closed center always has 1000 psi line pressure available to actuate the unloading valve.

TABLE 1—The operator of the charging machine controls the functions charted here.

MOTION	MOTIVE POWER	DIRECTION OF MOTION	TYPE OF MOTIVE POWER CONTROLLING DEVICE
TROLLEY TRAVEL	ELECTRIC MOTOR	FORWARD AND REVERSE	MANUAL CONTROL OF FACE-PLATE CONTROLLER THROUGH A CHAIN DRIVE.
BRIDGE TRAVEL	ELECTRIC MOTOR	INTO AND OUT OF FURNACE OR FORGING PRESS	
SLEWING	HYDRAULIC MOTOR	CLOCKWISE AND COUNTER-CLOCKWISE	MANUAL CONTROL OF HYDRAULIC FOUR-WAY VALVES THROUGH HYDRAULIC REMOTE CONTROLLER.
PEEL ROTATION	HYDRAULIC MOTOR	CLOCKWISE AND COUNTER-CLOCKWISE	
PEEL HOIST	HYDRAULIC CYLINDER	RAISING AND LOWERING	
TONGS	HYDRAULIC CYLINDER	OPEN TONGS AND GRIP TONGS	
FURNACE DOORS	ELECTRIC MOTOR	OPEN AND CLOSE DOORS	PUSH-BUTTON CONTROL THROUGH ELECTRICAL CONTROL
DESCALER	AIR CYLINDER	OPEN AND CLOSE DESCALER	



FIFTY TONS per hour of rock are fed into the "Hydrocone" crusher seen on the right.

Accumulator System Provides OVERLOAD PROTECTION on Crusher

DESIGN of a gyratory crusher for stone and ore requires an effective, rugged mechanism which will pass uncrushable material without damage. Further, the crusher must include some means of conveniently and accurately adjusting for product size and compensating for wear on the crushing surfaces.

Hydraulic power was selected by Allis-Chalmers engineers to meet these two requirements in their

"HYDROCONE" GYRATORY crushers are hydraulically adjusted, to provide a means of rapidly changing product size or compensating for wear on crushing surfaces. A 3 piece step bearing accomodates gyrating motion of the mainshaft and transmits pressure to the hydraulic jack.

HYDRAULIC CONTROL also provides for fast unloading of the crushing chamber in case of power failure or other emergency; and protects the crusher against tramp iron or other uncrushable materials in the crushing chamber.

design of the "Hydrocone" crusher. Product size and wear adjustment is accomplished by the "speed-set" control, and protection against overload is provided by the "automatic reset" which consists of one or more bladder type accumulators.

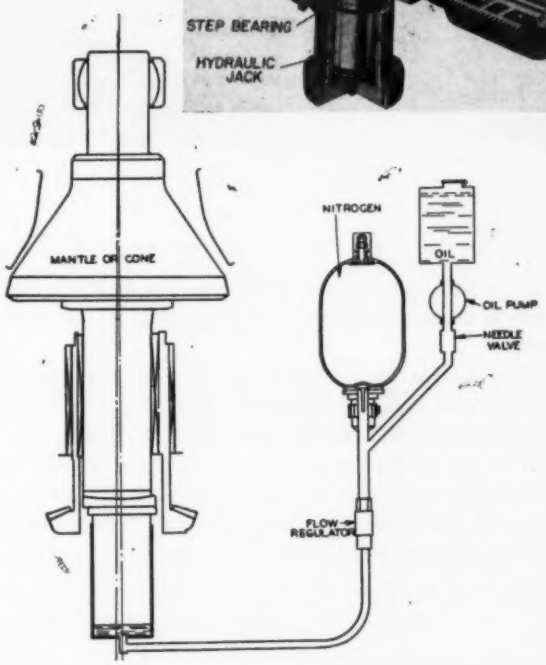
Adjustment for Product Size

On the 84 inch crusher—Allis-Chalmers builds these crushers in sizes from 22 to 84 inches—the crusher head is supported by a 28 inch diameter hydraulic jack which has a maximum stroke of 15 inches. The position of the inner crusher cone relative to the outer cone, or concave ring, is the crusher setting for product size. This setting can be controlled by the amount of oil in the jack. The "speed-set" control raises or lowers the crushing shaft assembly hydraulically. On crushers in sizes up to 48 inches, a hand pump is used to remove or add oil to the jack. On the larger sizes a motor driven gear pump is used. Pump rotation is changed at the push button station and the pump rotates only when a push button is held depressed.

The downward thrust of the mainshaft assembly, as well as its gyrating and rotating motion, is carried on a highly efficient step bearing.

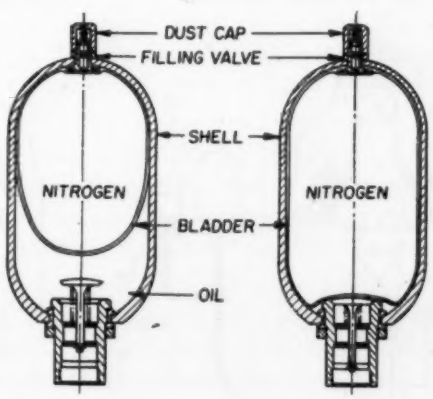
Gyratory motion is imparted to the crushing head by means of an eccentric at the lower end of the mainshaft. The eccentric is rotated by means of a bevel gear and pinion from the countershaft.

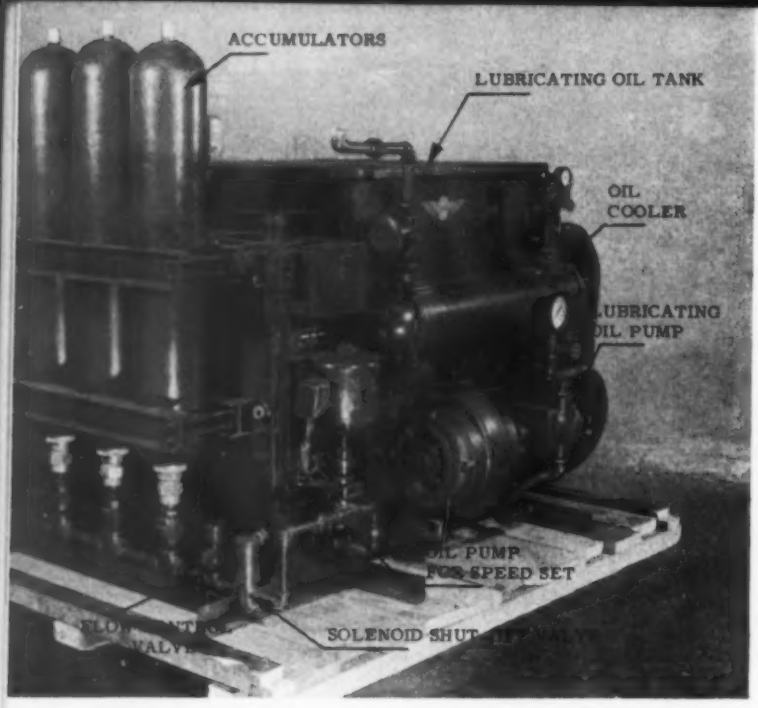
The commercial hydropneumatic accumulators are charged with nitrogen to a pressure exceeding the oil pressure in the hydraulic jack. During normal operation this pressure is 300 to 1200 psi depending on crusher size. At 800 psi pressure, with the 28 inch diameter jack on the large crusher, a crushing force of approximately 25 tons can be exerted before oil will be forced out of the jack to the accumulator. Any uncrushable material entering the crushing space will increase the force on the jack causing the oil pressure to overcome the gas pressure in the accumulator. The jack will lower by the amount of oil forced back into the accumulator and the uncrushable material will pass through the widened crusher space. When the material causing overload has been discharged, gas pres-



ACCUMULATORS provide a cushion and oil storage chamber to permit the inner crusher cone to "float" on oil. With the crusher head in normal operating position the gas charge fills the accumulator.

When the crusher head is forced down by uncrushable material entering between the cones, oil is stored in the accumulator.





VIEW OF THE hydraulic system for "automatic reset" and "speed-set" control, and the lubricating system for the crusher. This unit is used on the 84 inch crusher. Three 10 gallon accumulators provide for automatic reset. A 5 gpm motor driven pump is used to pump oil to or from the crusher jack to control the crushing space between crusher cones.

sure in the accumulator will force the oil back into the jack to automatically reset the position of the crushing cones.

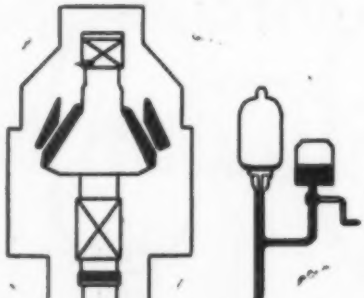
The accumulator system returns the crushing head quietly and rapidly without shock. It also protects the crusher against packing and power surges.

Valving in this system is very simple. Flow control valves between the accumulator and hydraulic jack keep oil velocities at a safe level. The "automatic reset" functions separately from the "speed set" control. To isolate the pump from the accumulator and ram, after the product size has been set, a needle valve is used when a hand pump is in the system. A solenoid operated shut-off valve is used with the motor driven pump. Pushbutton operation opens the valve at the same time pump rotation starts. When pumping stops, the solenoid operated shutoff valve closes.

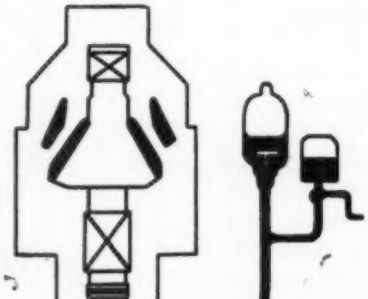
On this heavy service in the outdoors, hydraulic operation has proved efficient and free from excessive maintenance requirements.

"Automatic Re-Set" Operation

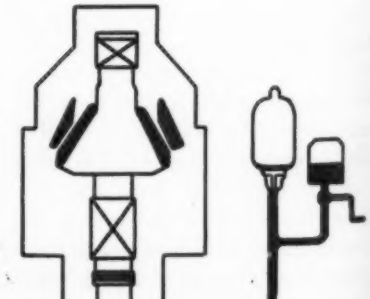
In normal operation, oil in hydraulic jack maintains position of crushing cone with respect the concave ring. Gas pressure in accumulator exceeds oil pressure in hydraulic jack. The hand pump shown on this sketch is not operated for the reset function.



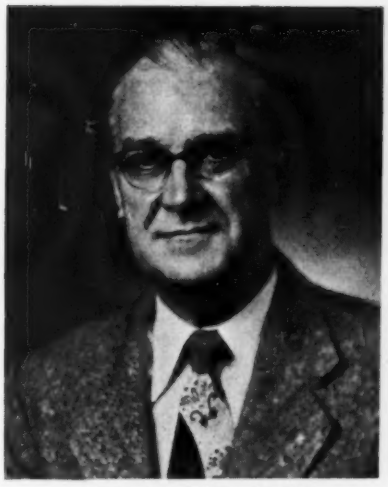
When tramp iron enters crushing chamber, pressure on oil in hydraulic jack becomes greater than gas pressure in accumulator. This forces oil from hydraulic system to accumulator, allowing crushing cone to lower until tramp iron is discharged.



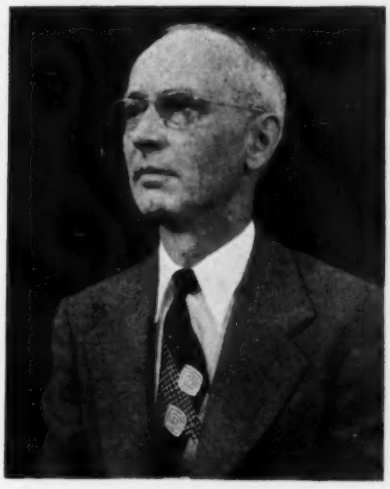
After tramp iron has been passed, gas pressure forces oil back to hydraulic jack. Crushing cone returns to original setting because same amount of oil is returned. The hand pump is used to add or remove oil from the jack when crusher setting requires changing.



Walter Ernst
The Commonwealth Engineering Company of Ohio



Dean M. Cleaveland
Bendix Products Division
Bendix Aviation Corporation



J. R. Hemeon
Ternstedt Division
General Motors Corporation

Judges Announced for First PRIZE PAPER CONTEST

THE publishers of APPLIED HYDRAULICS announce the acceptance of three outstanding authorities to serve as judges in the Prize Contest. These men are: J. R. Hemeon, Hydraulic Equipment Engineer, Ternstedt Division, General Motors Corporation, Trenton Plant; Dean M. Cleaveland, Plant Lubrication Engineer, Bendix Products Division, Bendix Aviation Corporation; and Walter Ernst, Vice President and Director of Engineering, The Commonwealth Engineering Company of Ohio.

J. R. Hemeon

Mr. Hemeon holds a B. S. in Mechanical Engineering from Massachusetts Institute of Technology. He is a charter member of Tau Beta Pi (1922). From 1942 to 1945, Mr. Hemeon was with Eastern Aircraft Division of General Motors Corporation as Hydraulic Engineer on T. B. M. Torpedo Bomber Aeroplane for the Navy. Since 1945 he has been with the Ternstedt Division of General Motors Corporation as Hydraulic Equipment Engineer of the Trenton, N. J. Plant. He is a member of Society of Automotive Engineers and a member of the Board of Governors of the Engineers' Club of Trenton.

Continued on page 101

Here are the prizes offered for articles in the fluid power field

Seven cash prizes totaling $1200.00 have been established for the APPLIED HYDRAULICS Prize Article Contest. First prize is $500.00, second prize $300.00, third prize $200.00; fourth, fifth, sixth and seventh prizes of $50.00 each are offered.

Contestants may choose any subject on the design, application or maintenance of hydraulic or pneumatic components, assemblies and systems to industrial equipment.

A special group of Student Prizes is also offered. First prize is $150.00, second prize $100.00 and third prize $50.00. Senior undergraduate as well as graduate students in recognized engineering schools are eligible to compete. Details for the Student Prizes are being sent to a number of leading engineering schools.

The procedure to enter the Prize Contest is very simple. Write to the APPLIED HYDRAULICS Prize Contest Editor, 1240 Ontario St., Cleveland 13, Ohio and ask for an official entry blank. Suggestions and Contest rules will be sent with the entry blank.

Design and Application of Flared Fittings

Part 6 of a series on Fluid Lines

By R. W. Phillips

AN Fittings

At the beginning of World War II, two fittings were in common use in aircraft service and one had just been eliminated. Those in service were the 811 and NAF fittings. The 810 fittings had just been eliminated as a standard. Since aircraft were to be shipped all over the world, it was imperative that types of fittings be reduced in number as rapidly as possible. The SAE, fittings manufacturers, the Air Forces and the Navy Bureau of Aeronautics (BuAer), represented by key personnel, got together to attempt to standardize tube fittings for aircraft service. The results of the conferences featured the basic AN fitting design, which is now the aircraft standard flared fitting. The design embodied all the good points of the two fittings from which it was derived. Figure 1 shows the AC811 standard fitting.

The AN fitting, Figure 2, consists of three pieces in one form, two pieces in the other. The three piece fitting consists of a tube nut (AN818), Figure 3, a sleeve (AN819), Figure 4, and a connector. The two piece fitting consists of a tube nut (AN817) and a connector. The sealing occurs between the nose of the fitting and the flare of the tubing. The sleeve tends to concentrate the force applied to the flare.

The connector is an externally threaded part with a straight, unthreaded section before the sealing surface. The sealing surface has an angle of 37 degrees.

Fig. 1. The AC811 standard fitting, which superceded the AC810 fitting. Its three piece construction proved excellent for aircraft hydraulic systems, with better performance under vibration, easy assembly and minimum amount of assembly clearance. Designed in several weights for heavier wall thicknesses, it is also widely used in the industrial field.

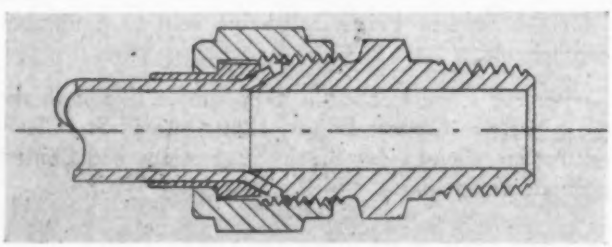
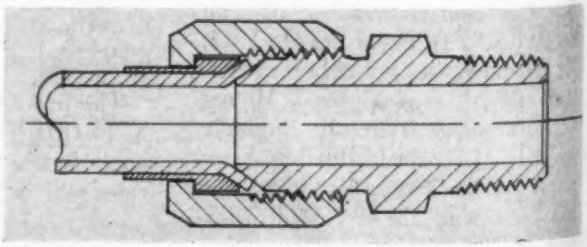
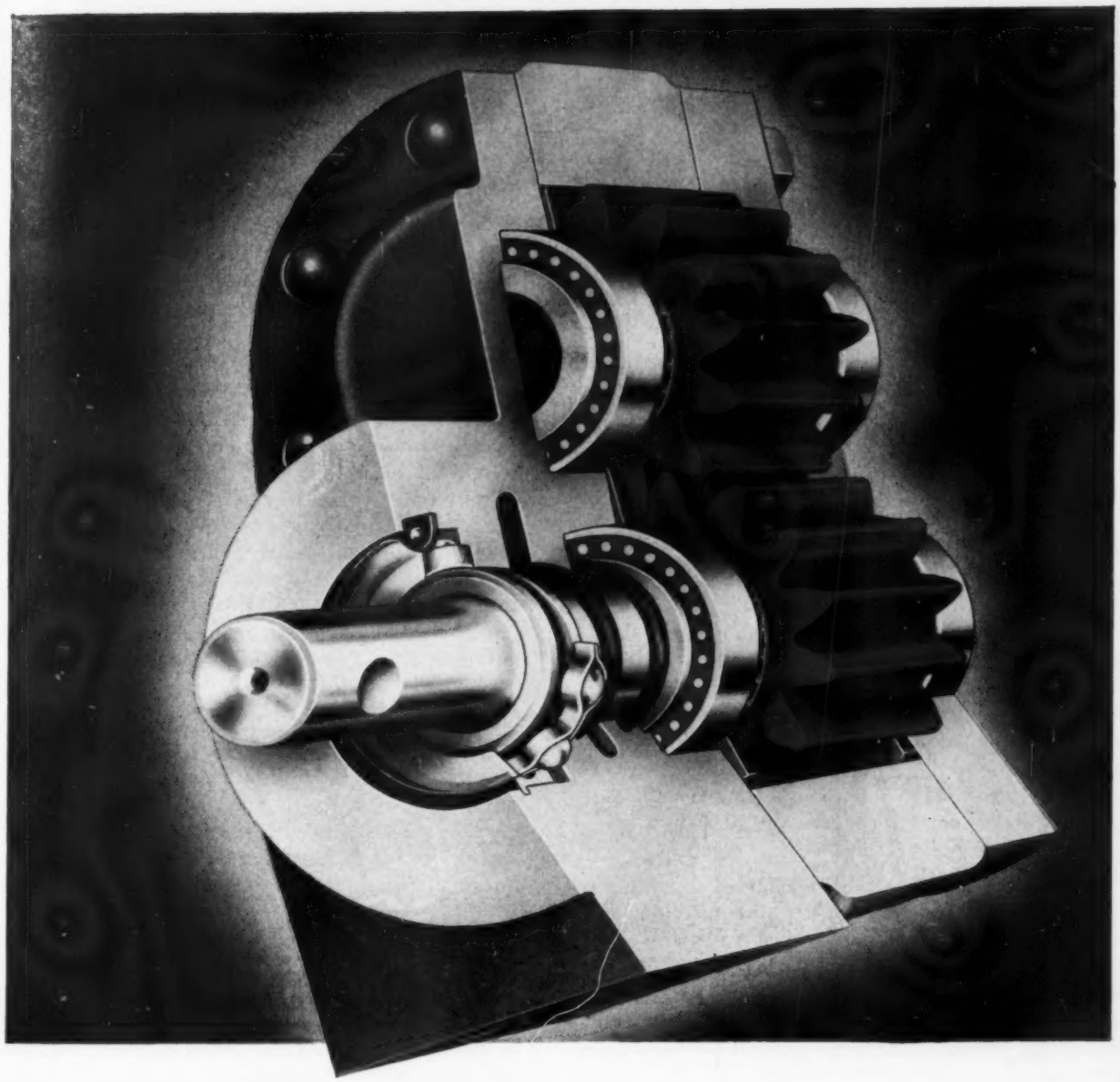


Fig. 2. The AN fitting, introduced in 1942 for aircraft installations, was based on the AC811 design. Threads were standardized and lengths of thread contacts made maximum. The angle of flare was changed to 37 degrees to give maximum contact for the flare. This design is still standard on 1500 and 3000 psi aircraft hydraulic systems. The JIC (and SAE) 37 degree flared fitting is an industrial version of the AN flared fitting.





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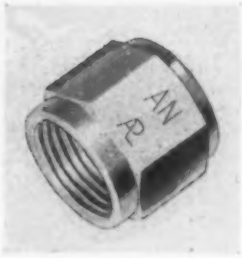


Fig. 3. The short tube nut, AN818, used in the three piece AN fitting.

Fig. 4. The sleeve, AN819, used with the short nut, AN818 and connector in the three piece AN fitting.

The nut is internally threaded. There are two types, a short nut (AN818), which requires the use of a sleeve (AN819) and a long nut (AN817), which combines the functions of the 818 and the 819 sleeve.

The sleeve consists of a tube with an external shoulder against which the 818 nut acts and two angles internally which force the tubing against the flare angle of the seat. The AN819 sleeve can turn during assembly to allow some accumulation for eccentricity of the tubing or nose of the connector. This advantage is not present in the AN817 combination. However, the long nut may have some merit over the 819 sleeve as a vibration dampener.

The first operation in the assembly of the fitting is to apply the nut and sleeve to the piece of tubing prepared for assembly. The flare is then made with either a flaring machine or a hand flaring tool. The flare should be checked for dimensions (see part 2, July issue, APPLIED HYDRAULICS). Thin wall soft tubing should be double flared to prevent the flare from pinching off.

The nose in front of the threads permits the AN fitting to be used with very thin walled tubing with no assembly problems involving run out of threads in the nut. The final tightening is accomplished by applying the torques listed in Table 1 to the flared tubing. Each material used will require a different torque; torques will vary with thread tolerance and thread roughness, but no other satisfactory method has been developed for assembling flared fittings. The torques in Table 1 are those taken from AND 10064 and other data supplied by users of AN fittings. Torques apply to steel fittings in sizes ⅛ to 5/16 inclusive and to aluminum in larger sizes except where noted.

AN fittings will give satisfactory service in all sizes for operation at 3000 psi when made from a sufficiently strong material. At higher pressures the fitting will perform satisfactorily if all steel parts are used and special flaring care and working in of the flare on the seat is exercised. In conditions under which very severe vibration occurs, the nut should be lock-wired to prevent loosening. Care should also be taken to support the tubing adequately to prevent damage to the flare. The long nut (AN817) will give somewhat better vibration protection to the flare. The long nut (AN817) will give somewhat better vibration performance than the short nut (AN818) and sleeve (AN819) combination, but cannot be installed in as close an installation because greater length is required behind the nut.

AN fittings are available in steel, stainless steel, aluminum and brass. Since they are somewhat more expensive than fittings previously described, these fittings are used where greater pressure and higher requirements are called for. Because the angle of the flare is less, it is somewhat easier to prepare a flare for an AN fitting than for the 45 degree flared fitting.

JIC Flared Fittings

The General Motors Corporation standardized fittings for use on their production equipment in order to increase the interchangeability of parts and reduce the servicing and maintenance problems encountered when all types of fittings are used.

Manufacturers of fittings and equipment, working with the General Motors Corporation, developed the JIC Standards which were applied to 37 degree flared fittings. The 37 degree flared fitting was adopted as a standard for flared fittings being used on machine

Continued on page 76

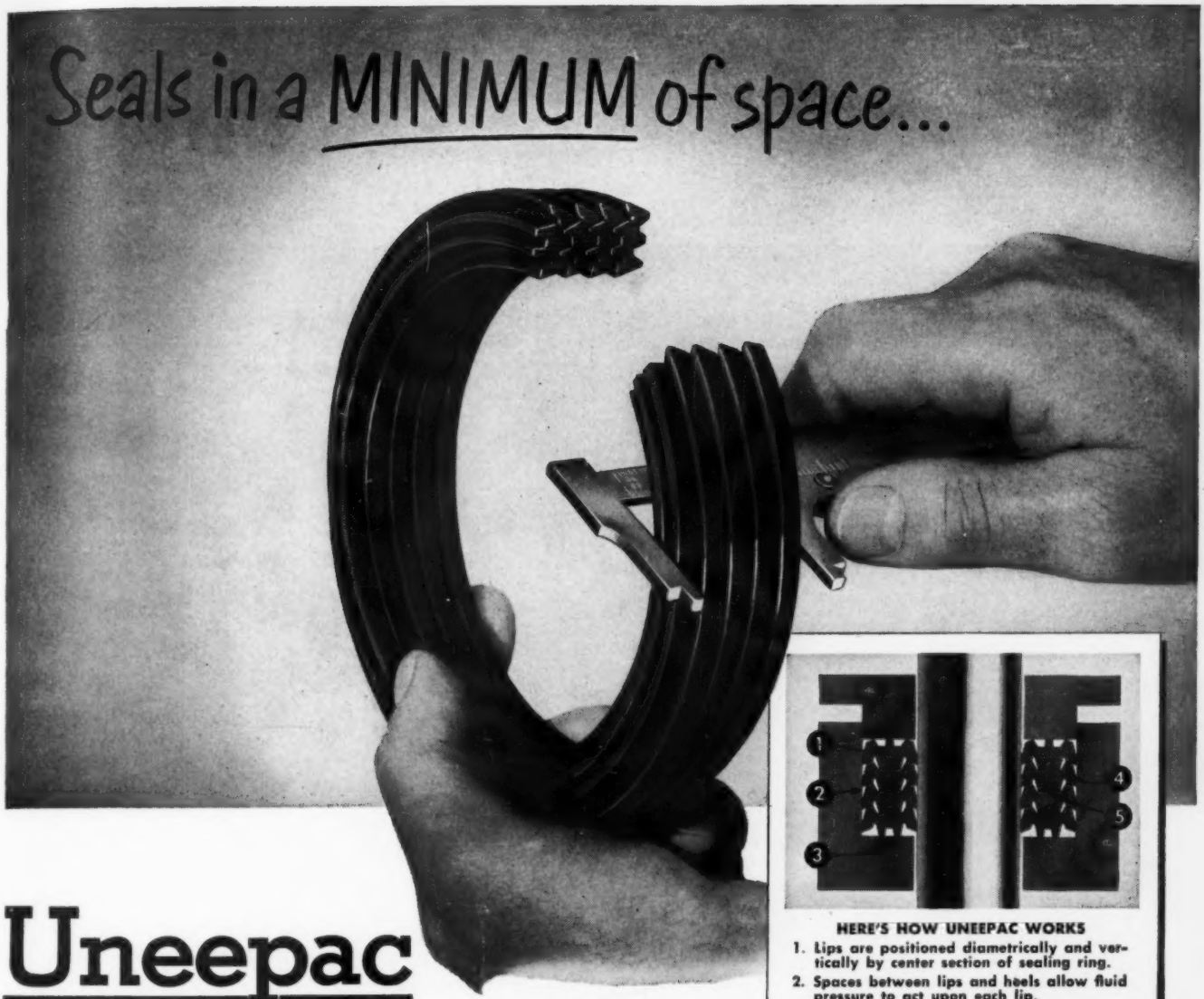
Table 1 Torque values for AN fittings in inch-lbs.

Size	3S-52S0	61ST	Stainless Annealed	Stainless ⅛, ¼ hard
3	35-60	90-110	90-100	same values
4	40-65	130-150	135-150	as annealed
5	60-80	140-180	180-200	
6	75-125	180-220	270-300	
8	150-250	500-600	450-500	
10	200-350	600-700	650-700	
12	300-500	700-800	400-1000	
16	500-700	—	1200-1400	
20	600-900	—	—	
24	600-900	—	—	

Table 2 Torque values for JIC flared fittings in inch-lbs.

Size	Dash No.	Tread Size	1010 and Bundy, Min.	Stainless Min.	Copper Min.
⅛	2	5/16-24	50		30
3/16	3	⅜-24	70	90	40
¼	4	7/16-20	90	135	50
5/16	5	½-20	120	180	80
⅜	6	9/16-18	175	270	110
½	8	¾-16	350	450	200
⅝	10	⅞-14	450	700	300
¾	12	1-1/16-12	600	1000	450
1	16	1 3/16-12	—	1300	600

Seals in a MINIMUM of space...



HERE'S HOW UNEEPAC WORKS

1. Lips are positioned diametrically and vertically by center section of sealing ring.
2. Spaces between lips and heels allow fluid pressure to act upon each lip.
3. Lips are protected by the projecting portion of center section against damage by excessive gland pressure.
4. Lips are supported to prevent collapse or distortion by excessive fluid pressure.
5. Each ring correctly centers itself on the preceding ring so that they align vertically and nest perfectly.

Uneepac

...the new Johns-Manville automatic ring packing

EQUIPMENT DESIGNERS are finding that this newest Johns-Manville packing development enables them to hold stuffing-box sizes to a minimum . . . thereby save both space and machining.

This ability of Uneepac to provide high sealing efficiency in minimum packing depth results from the fact that each ring is a complete self-contained packing unit. Uneepac is designed so that the center section of each ring positions the lips and protects them from excessive gland pressure. Header and follower rings are therefore seldom required.

In addition, Uneepac offers other advantages that are important both to the designer and the user:

SIMPLIFIED INSTALLATION—Each Uneepac ring centers itself on the preceding ring so that the entire set is aligned vertically and nested perfectly. This feature practically insures trouble-free installation.

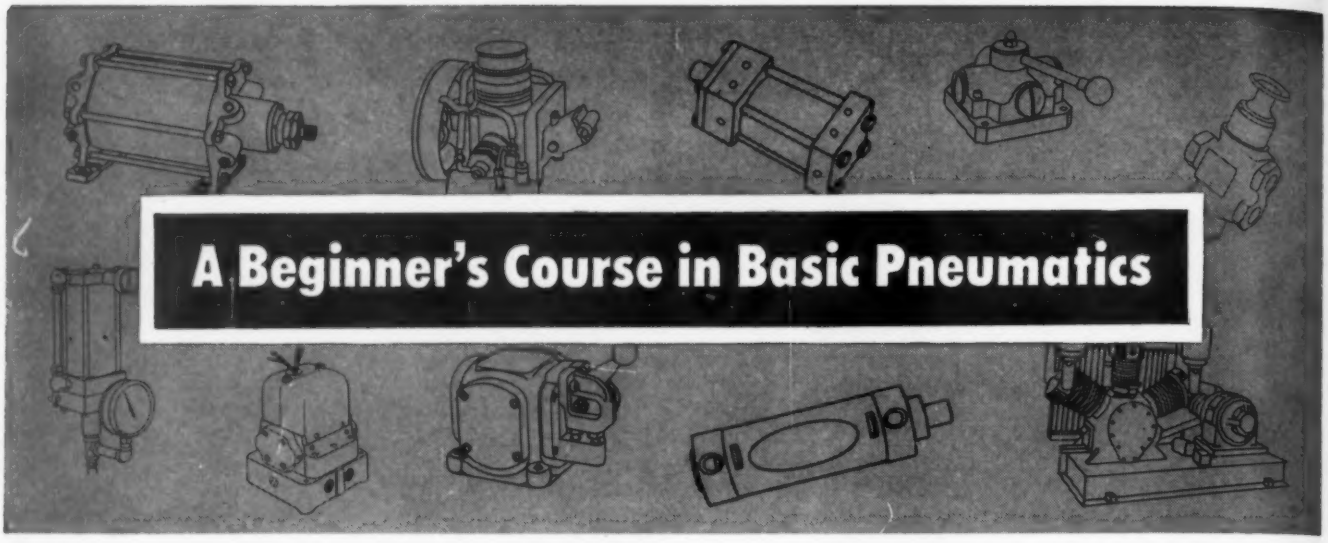
MORE EFFICIENT SEALING—Because it is designed so that each lip is always exposed to fluid pressure, Uneepac has excellent pressure sensitivity . . . is instantly responsive to fluid pressure changes.

REDUCED FRICTION AND WEAR—The operation of this new automatic packing is completely independent of gland pressure. This reduces friction to a minimum—saves wear on both rod and packing—and contributes to longer life with corresponding reductions in down time for replacements.

Uneepac is available in sizes from ⅝″ inside diameter to 63″ outside diameter. For complete information, write Johns-Manville, Box 60, N. Y. 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS



A Beginner's Course in Basic Pneumatics

Section II

The Distribution System

Part III

Friction Losses of System Components

SO far we have considered friction losses in straight piping only. Friction losses in bends or turns, fittings and valves must also be included in the design and layout of an air distribution system so that the most efficient combination of size of pipe, minimum pressure drop, initial absolute pressure for volume of air delivered (cfm of free air) is selected to produce the best possible working pressure at the component to be actuated.

It must be pointed out that there are some other factors which may be important in some systems under some conditions which are neglected in our discussion. The effect of sudden changes of distribution line diameters (both from a larger to a smaller and from a smaller to a larger diameter), the effect of the main distribution lines as additional receiver capacity, the effect of moisture in the air and the number and location of traps have been omitted to clarify the principles of pressure losses in air lines.

Extensive studies have indicated that the pressure drop through bends, fittings, valves and cylinders can be conveniently expressed in terms of equivalent lengths of straight pipe. Table I gives the loss of pressure through screw pipe fittings and Table 2 gives equivalent lengths of straight pipe in feet for valves and cylinders.

Computing System Losses

Figure 1 is a diagrammatic sketch of an air distribution system with main line, branch lines, fittings and work units. Following the same procedure as detailed in part 2, the total friction losses can be determined. From a receiver of adequate size we have a main line 2 inches in size to the junction with the first branch and 1½ inches in size to the junction with the second branch. Our system handles 400 cfm of free air with initial pressure atmospheric and final pressure

Pressure drop in
100 feet of 2 inch main
line ..... = 1 psi
First long radius ell,
flanged ..... = .02 psi
Second standard ell,
flanged ..... = .04 psi
Pressure drop to Branch
No. 1 ..... = 1.06 psi
Branch No. 1

Tee through side
outlet ..... = .14 psi
Standard tee, screwed . = .05 psi
40 feet of 1 inch line .. = 1.00 psi
10 feet of ¾ inch line . = .24 psi
¾ inch, two-way valve . = .24 psi
Cylinder ..... = .24 psi
Total pressure loss . 2.97 or 3 psi

Pressure drop to Branch
No. 2 ..... = 2.2 psi
Branch No. 2
Tee through side
outlet ..... = .14 psi
60 feet of 1 inch line . = 1.50 psi
1 inch, four-way valve . = .65 psi
Cylinder ..... = .33 psi
Total pressure loss . 4.82 or 5 psi

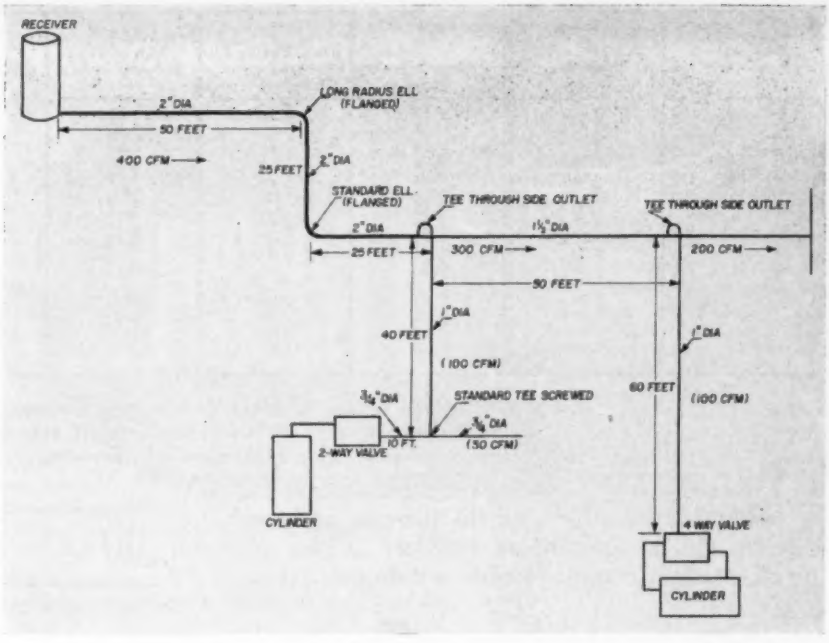


Figure 1. Diagram of an air distribution system with bends, fittings, valves and cylinders. Not to scale.

110 psi gauge. We will also assume a full flow to the first branch junction, 300 cfm to the second junction and 200 cfm to the rest of the system beyond the second branch junction.

We will solve by using the Harris formula (November installment) and checking with factors of flow given in Figures 2 and 3 (November installment).

First find our pressure drop in the main line to the first junction (100 feet of 2 inch line)

$$\text{The ratio of compression, } r = \frac{124.7}{14.7} = 8.48 = 8.5$$

$$f = \frac{.1025 \times 100}{8.5} \times \frac{6.7 \times 6.7}{48.06}$$

$$= 1.2 \times .934 = 1.12 = 1 \text{ psi}$$

check by Table, Figure 3

$$\frac{94.7}{8.5} = 11.14 \text{ for 1000 feet or } \frac{100}{1000} \times 11.14$$

$$= 1.1 = 1 \text{ psi}$$

Similarly, the pressure loss in 50 feet of the 1½ inch line can be computed:

$$\text{The ratio of compression, } r = \frac{123.7}{14.7} = 8.4$$

$$f = \frac{.1025 \times 50}{8.4} \times \frac{5 \times 5}{12.68} =$$

$$.603 \times 1.97 = 1.187 = 1.2 \text{ psi}$$

check by Table, Figure 2

$$\frac{201}{8.4} = 24.2 \text{ for 1000 feet or } \frac{50}{1000} \times 24.2 =$$

1.2 psi

We then proceed to find the pressure losses for the two turns in the 2 inch line before the junction with branch 1 (Figure 1).

The first turn is a long radius ell, flanged. Table 1 gives an equivalent length of 2.07. Since the flanged fitting has ¾ of the resistance of screwed elbows and tees, actual equivalent is:

$\frac{3}{4} \times 2.07 = 1.55 = 1.6$ feet equivalent

$$\text{By formula } \frac{.1025 \times 1.6}{8.5} \times \frac{6.7 \times 6.7}{48.06} =$$

$$.0193 \times .934 = .018 = .02 \text{ psi}$$

check by Table, Figure 3

$$\frac{94.7}{8.5} = 11.14 \text{ for 1000 feet or } .017 =$$

.02 psi for 1.6 feet

The second turn is a standard ell, flanged. Table 1 gives an equivalent length of 5.17. Since it is flanged the value for actual equivalent is:

$\frac{3}{4} \times 5.17 = 3.89 = 3.9$ feet

$$\text{By formula } \frac{.1025 \times 3.9}{8.5} \times \frac{6.7 \times 6.7}{48.06} =$$

$$.047 \times .934 = .0438 = .04 \text{ psi}$$

check by Table, Figure 3

$$\frac{94.7}{8.5} = 11.14 \text{ for 1000 feet or } .043 = .04 \text{ psi}$$

Nominal Pipe Size, Inches	Actual Inside Diameter, Inches	Gate Valve	Long Radius Ell or on Run of Standard Tee	Standard Ell or on Run of Tee Reduced in Size 50 per cent	Angle Valve	Close Return Bend	Tee Through Side Outlet
½	0.622	0.36	0.62	1.55	8.65	3.47	3.10
¾	0.824	0.48	0.82	2.06	11.4	4.60	4.12
1	1.049	0.61	1.05	2.62	14.6	5.82	5.24
1¼	1.380	0.81	1.38	3.45	19.1	7.66	6.90
1½	1.610	0.94	1.61	4.02	22.4	8.95	8.04
2	2.067	1.21	2.07	5.17	28.7	11.5	10.3
2½	2.469	1.44	2.47	6.16	34.3	13.7	12.3
3	3.068	1.79	3.07	6.16	42.6	17.1	15.3
4	4.026	2.35	4.03	7.67	56.0	22.4	20.2
5	5.047	2.94	5.05	10.1	70.0	28.0	25.2
6	6.065	3.54	6.07	15.2	84.1	33.8	30.4
8	7.981	4.65	7.98	20.0	111.	44.6	40.0
10	10.020	5.85	10.00	25.0	139.	55.7	50.0
12	11.940	6.96	11.0	29.8	166.	66.3	59.6

Table 1. Pressure Losses Through Screw Pipe Fittings
(a) Flanged fittings have ¾ the resistance of screwed elbows and tees
(b) Pressure drop is same regardless of operating pressures

The total pressure drop to the junction of branch 1 is the sum of the straight line loss (1 psi) plus the two turns (.02 and .04 psi) or 1.06 psi.

Branch No. 1

The initial pressure for branch 1 is 124.7 — 1.06 = 123.6 psi

For the tee through the side outlet at Branch No. 1 we determine from Table 1 that the tee has a pressure loss value of 5.24 equivalent feet of straight pipe.

By formula

$$\frac{.1025 \times 5.24}{8.4} \times \frac{1.6 \times 1.6}{1.291} = .0639 \times 1.98 = .1265 = .13 \text{ psi}$$

check by Table, Figure 2

$$\frac{217.4}{8.4} = 25.88 \text{ for 1000 feet or .1356 or .14 psi}$$

The pressure drop of the 40 feet of 1 inch line is found

By formula $\frac{.1025 \times 40}{8.4} \times \frac{1.6 \times 1.6}{1.291} =$

$.488 \times 1.98 = .966 = 1$ psi

check by Table, Figure 2

$$\frac{217.4}{8.4} = 26.1 \text{ for 1000 feet or } 1.04 =$$

1 psi for 40 feet

A standard tee, screwed, is the next turn in the system. We find in Table 1, value for run of tee, an equivalent length of 2.06 feet. Since it is a screwed fitting the full Table value is taken.

The pressure loss would be, by formula:

$$\frac{.1025 \times 2.07}{8.3} \times \frac{.83 \times .83}{.3561} =$$

$.02556 \times 1.934 = .049 = .05$ psi

size	*Cylinders and 2-, 3-way valves*	*4-way valves*
½	6 to 30	12 to 60
¾	10 to 50	20 to 100
1	13 to 65	25 to 125
1¼	15 to 75	30 to 150
1½	20 to 100	40 to 200
2	25 to 125	50 to 250

Table 2 Equivalent Lengths of Straight Pipe in Feet for Valves and Cylinders

check by Table, Figure 2

$$\frac{199}{8.3} = 23.9 \text{ for 1000 feet or } .0494 = .05 \text{ psi}$$

Next, we have 10 feet of ¾ inch pipe. The pressure drop would be, by formula

$$\frac{.1025 \times 10}{8.3} \times \frac{.83 \times .83}{.3561} =$$

$.123 \times 1.934 = .237 = .24$ psi

check by Table 2

$$\frac{199}{8.3} = 23.9 \text{ for 1000 feet or .239 or}$$

.24 psi for 10 feet

At this point we must make an assumption for a value for a valve and a cylinder pressure loss because manufacturers of pneumatic units have not published tables which show loss due to friction through fittings, valves or cylinders in terms of equivalent length of straight pipe in feet. Table 1 is a general table for steam, air and gas and is widely used in lieu of more specific data.

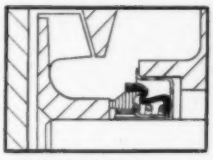
In some cases the engineering departments of valve and cylinder manufacturers can furnish reasonably accurate working estimates of pressure losses through

Continued on page 77

NEW PACKAGE SEAL—small shafts

JOHN CRANE

THE Pressed-In SEAL

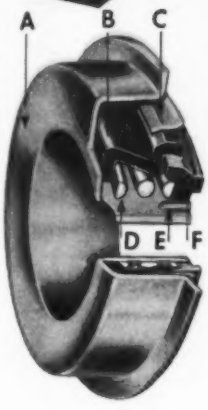


A. Seal Retainer.
B. Synthetic Rubber Bellows.
C. Metal Band.
D. Spring.
E. Holding Dents.
F. Precision-Lapped Sealing Washer.

POINT FOR POINT

1. Is a low cost unit.
2. Simplifies machine design.
3. Saves on manufacturing costs.
4. Provides a positive drive.
5. Eliminates all torque strains on flexing member.
6. Compensates for washer wear.
7. Has plenty of axial and radial movement.
8. Protects component parts.
9. Assures a liquid-tight job.
10. Improves performance.
11. Permits perfect lubrication.
12. Has lapped faces.
13. Has plenty of take-up.
14. Uses only selected rubber stocks.
15. Minimizes cavitation around pump shafts.
16. Permits cooling of rubbing faces.
17. Is a production line item.
18. Is individually tested.

LOW COST



STATIONARY SEALING HEAD TYPE 11-A

This pressed-in packaged sealing unit is designed to protect the spiral steel spring inside of the synthetic rubber bellows against corrosion.

The spring clamps the flange of the bellows tight against the bottom of retainer and the metal ferrule squeezes the top portion of the bellows against the "Teeplelite" washer.

This liquid-tight seal is especially recommended for small shafts on *hot or cold water, oil, gasoline, kerosene, soapy water.*

Use this seal on: *Low Pressures* 35 PSI
Low Temperatures −65°F. to 220°F.

LOW COST

STATIONARY SEALING HEAD TYPE 6-A

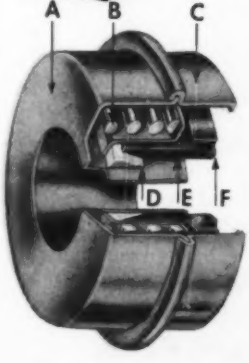
A. Seal Retainer.
B. Metal Ferrules.
C. Spring.
D. Precision-Lapped Sealing Washer.
E. Holding Dents.
F. Synthetic Rubber Bellows.

This pressed-in packaged sealing unit is designed with a spiral steel cadmium plated spring (stainless or bronze optional) assembled between two metal ferrules which clamp the flanges of the synthetic rubber bellows tightly against the retainer shell and the "Teeplelite" washer.

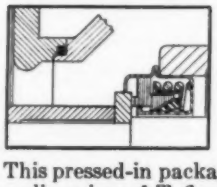
This liquid-tight seal is especially recommended for small shafts on *hot or cold water, oil, gasoline, kerosene, soapy water.*

Use this seal on: *Medium Pressures* 75 PSI
Low Temperatures −65°F. to 220°F.

LOW COST



STATIONARY SEALING HEAD TYPE 9-A



A. Seal Retainer.
B. Spring.
C. Sleeve.
D. Wedge of Teflon.
E. Sealing Washer.
F. Precision-Lapped Face.

This pressed-in packaged sealing unit is designed to use a wedge sealing ring of Teflon*. This wedge shaped sealing ring closely fits the inner sleeve of the retainer and makes a liquid-tight contact with cone surface of carbon washer.

The result is a liquid-tight seal which is especially recommended for *hot oil, and all chemical liquids or gases, hot or cold.*

Use this seal on: *High Pressures* 200 PSI
High Temperatures 350°F. *Low Temperatures* −100°F.

Crane Packing Company, 1805 W. Cuyler Ave., Chicago 13, Ill.

*Du Pont Trade-mark for tetrafluoroethylene resin

1. **Compact new packaged units.**
2. **Stationary sealing head, pressed-in type.**
3. **1/32" clearance around shaft, 1/4, 3/8, 1/2, 1" diameter.**
4. **No vibration.**
5. **Easy to install, easy to replace.**
6. **Liquid-tight.**
7. **Minimum friction, cool running.**
8. **Minimum wear, rubbing.**
9. **Great flexibility.**
10. **Inspected parts.**
11. **Tested.**
12. **Closer bearings.**
13. **Shorter shafts.**
14. **No shaft deflection.**
15. **No run-out.**
16. **High speed.**

▼

YOU NEED THIS NEW DATA!

SEND FOR CATALOG

CRANE PACKING COMPANY

High Pressure? . . . Low Pressure?

LOW PRESSURE OIL SYSTEMS In Machine Tools

This article tells why The Lapointe Machine Tool Company took "a step backwards" in the application of working pressure for hydraulic machines. Their broaches are designed with 750 psi systems. Lapointe's engineers feel problems of maintaining high pressure systems far outweigh any advantages in size and lower initial cost.

By Myer Fox

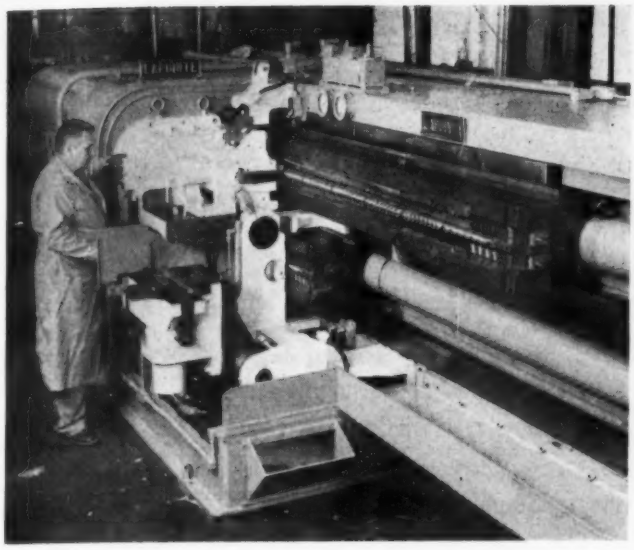
IN hydraulics there is a basic formula: Force = Pressure × Area. "Force" is the fixed constant which is the particular job that has to be done or the tonnage or capacity of a machine. Engineers have investigated the variables: "Pressure" and "Area". The economics of the end product plays a very important role in any engineering problem. The designers reasoned that if the pressure could be doubled, the area could be halved. Certainly it was an appealing goal to shoot for. Decreasing the area meant smaller cylinders. Maintaining the same speed with smaller cylinders meant smaller pumps, valves, pipe sizes, etc. In general, tremendous savings in hydraulic equipment would be realized. The manufacturers of machinery called upon the manufacturers of hydraulic equipment to design their products to withstand the higher pressures. These additional demands were thrown upon an industry still involved in the development and improvement of their existing product.

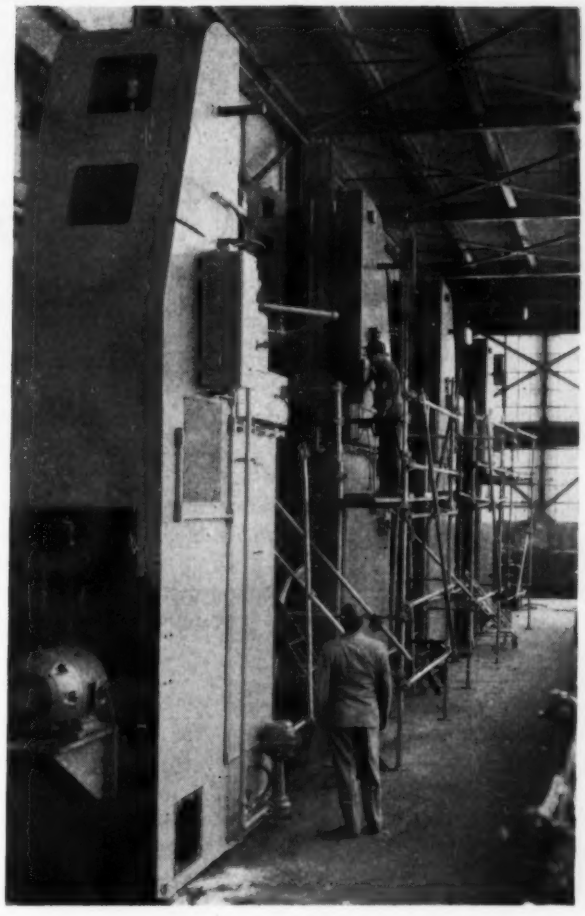
A new problem arose in industry—How to contain the higher pressures? The machinery manufacturers began to realize they had real trouble on their hands. *In all fairness, it must be emphasized that all parties concerned were partially to blame.* A good portion of the trouble was caused by the misuse and misapplication of the hydraulic equipment at the higher pressures by the machinery builders. Another group to blame was the hydraulic equipment manufacturers who were rating the pressures stamped on their nameplates based on test stand ratings. Any resemblance to the load while on the test stand and that required in the field is purely coincidental. Service to the machine in the field means continual stresses, strains and overloads. A portion of the blame must be taken by the users for the improper maintenance of hydraulic machinery, largely due to inexperienced personnel.

MYER FOX, Chief Electrical and Hydraulic Engineer, the Lapointe Machine Tool Company, Hudson, Massachusetts.

Problems of Heat, Shock and Vibration

Additional complications arose. Due to improved cutting tools, coolants and better control of the raw materials, production engineers demanded higher speeds which in turn meant larger volumes required





ON THE LAPOINTE line of vertical and horizontal broaches—the machines pictured here have a 90 inch stroke, 15 ton capacity—the hydraulic system is designed to deliver the rated tonnage at an operating pump pressure of 750 psi. Beside feeding the broaching tool, oil power is used for the clamping and auxiliary table movements. While this low pressure has required the use of large components, the hydraulic systems can be depended on to perform smoothly and continually without unusual maintenance.

. . . more intensive education in the application and care of hydraulic equipment is needed before high pressure systems can be widely used on machines tools . . .

at the higher pressures. Heat, shock and vibration in hydraulic equipment became more pronounced. All in all, industry was experiencing difficulty in maintaining their production due to downtime of their hydraulic equipment. Some companies were buying oil by the tank car quantity to replace the thousands of gallons that went down the drain. Oil absorbing products covered thousands of square feet of floor space in industry. Some users began to investigate other means of power transmission. Mechanical and electrical drives were being investigated as a replacement for hydraulics.

Increased Cost of Low Pressure

And that's the reason that the Lapointe Machine Tool Company decided to take "the step backwards". It was decided to obtain the rated tonnage or force of the machine at a lower pressure. Of course, it meant larger cylinders, larger pumps to maintain the same speed, larger valves, pipe sizes, etc., all leading to increased costs.

The reaction of industry more than compensated for the increased cost. It meant that the users could depend on their hydraulic equipment to perform as smoothly and continually as expected. One important factor was the use of the same pumps and valves that were rated for the higher pressures. It meant that at the lower pressures a greater factor of safety was present which also had a great deal to do with the uninterrupted operation of the machine.

Effect of JIC Conferences

During recent years, since the establishment of the Joint Industry Conference on hydraulics, (J.I.C.), the hydraulic component manufacturer, the machine builder and the user have made progress in eliminating misuse and misapplication of hydraulic equipment. Undoubtedly, the conferences, along with new developments and wider education in the application and care of hydraulic equipment will someday permit the machine builder to benefit by the use of high pressure. We don't believe that day is here.

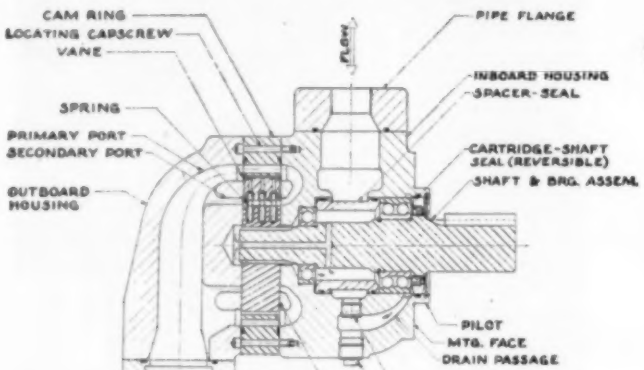


Fig. 1. Cross section of vane pump-motor.

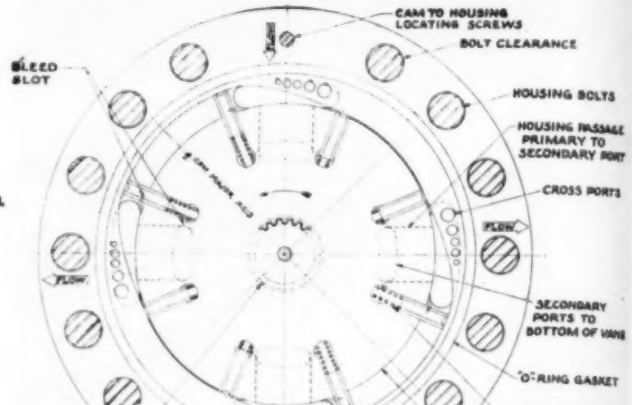


Fig. 2. Half section of the pump-motor.

Design of a 2000 psi VANE HYDRAULIC PUMP-MOTOR

Problems of porting, loading and manufacture had to be solved to create a compact, balanced power unit which would operate both as a pump or fluid motor

By John R. English

OUR problem was to design a series of vane type rotary power units that could be used interchangeably as pump or fluid motor at working pressures up to 2000 psi with reasonable overall and volumetric efficiencies.

Existing units would not meet our specifications for one or more of the following reasons:

1. Vane bearing loads on the cam ring would be excessive.
2. Vanes were too thin to resist hydraulic side load.
3. Vanes were inclined or unsymmetrical and unit could operate only in one direction of rotation.
4. Vanes would collapse inward if operated as a fluid motor unless a means of carrying higher pressure under the vane or mechanically loading

JOHN R. ENGLISH, Development Engineer, Denison Engineering Co., Columbus, Ohio.

the vane outward against the cam ring could be devised.

5. The unit would operate as a pump but not as a motor, or vice-versa.

Description of Pump-Motor Unit

The pump-motor, Figure 1, consists of an inboard housing casting in which a shaft is piloted with its supporting bearings and oil seal. The casting has cored primary ports and secondary connecting passages to the bottoms of the vanes. A cored drain passage is so designed to permit the unit to be internally or externally drained providing the shaft seal is reversed. The large size units have separable pipe flanges.

The pumping cartridge sub-assembly consists of the rotor, springs, vane and cam ring. On the smallest unit one spring per vane is used; the larger units use three springs per vane. Spring loads average about 5 pounds per spring. The load per inch of vane length is the important factor.

Proper rotor and vane to housing running clearance is maintained by close control of tolerances on the rotor thickness, vane length and cam ring thickness. Because of the good anti-galling and seizing properties of bronze the housing faces are electroplated with bronze.

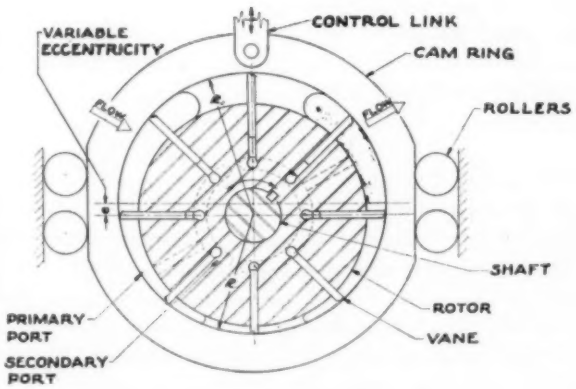
Arrangement of Ports

If the unit is externally drained, either port may be suction or pressure. The flange with the larger pipe tap should be placed on the desirable inlet housing. When internally drained, the inboard housing must be inlet as a pump or outlet as a motor. For fluid motor operation, the larger tapped flange may be bushed down to the same size as the smaller flange.

Blind radial holes in the rotor and two diameter through holes in the vanes provide seats and guides for the springs which hold the vanes out in contact with the cam ring.

To meet the requirement of reversible rotation without alteration of the internal parts, it was necessary

These are the Basic Vane Pump Designs . . .

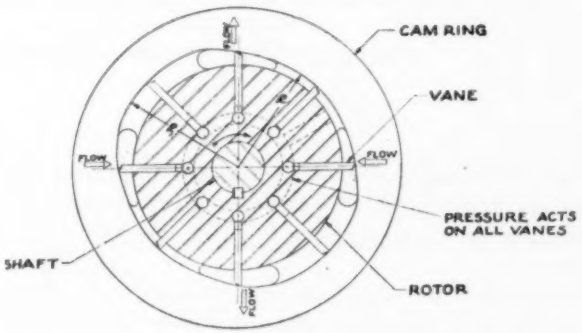


UNBALANCED DESIGN

There are two general types of rotary vane pumps in common use. The first is an unbalanced type having a circular cam or pressure ring which is eccentrically located to the rotor center. The vanes are usually pressure loaded radially outward against the cam ring after centrifugal force is great enough to throw the vanes outward into the correct pumping position and some pressure has been generated.

Centrifugal force alone may not be great enough to overcome sticking with high viscosity oil. The rotor is hydraulically unbalanced radially and very rugged bearings are required to support this load. It has only one pumping cycle for each revolution of the rotor. The vanes must move radially while crossing the seal between ports and may cause excessive wear on both vanes and cam ring.

The advantages of this type are simplified cam



BALANCED DESIGN

ring manufacture, ease of providing variable displacement by changing the eccentricity of the rotor to ring relationship, favorable cam wear conditions because of the long length of port are available and favorable cam wear condition because of a more gentle cam rise.

The balanced rotor design has two pumping cycles for each rotor revolution. It is difficult to use this design for a variable displacement unit. Cam wear may be greater than in the unbalanced type because of a more abrupt cam rise. With under vane porting, pressure is carried under the vane during the entire cycle causing the vane to be fully unbalanced while crossing the suction ports and small cam radii seal resulting in excessive wear and power losses. Vanes may stick in slots and pump will not prime due to low rpm or high oil viscosity.

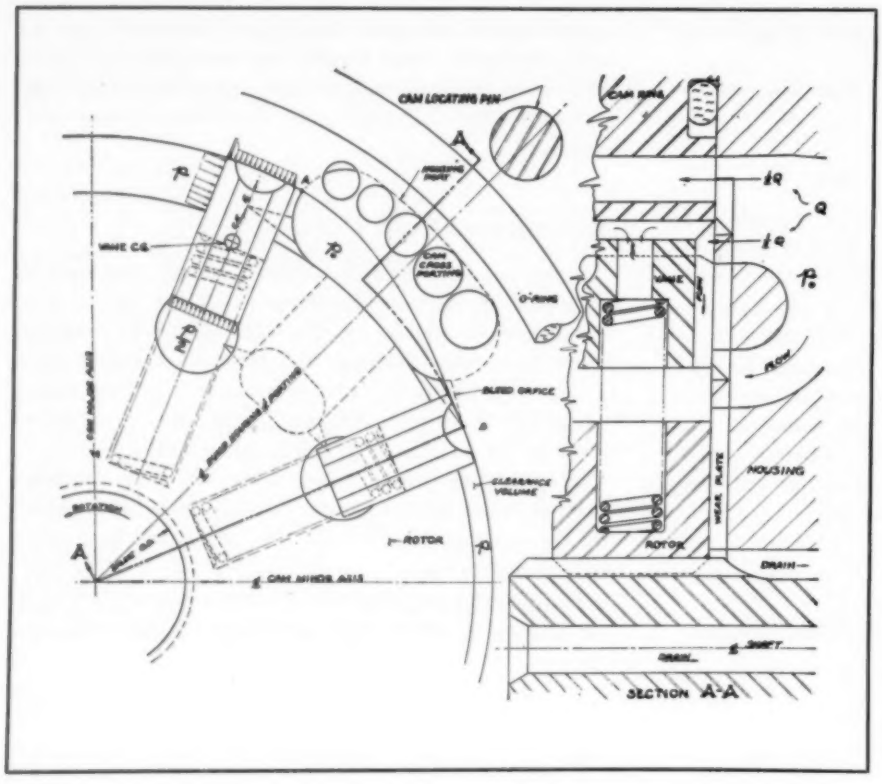


Fig. 3. Porting and loading of the pump-motor is shown in this section. There are radial passages from inner to outer ends of the vanes. Pressure balancing relieves hydraulic bearing loads between vanes and cam ring.

. . . development of a power unit which may be used as a pump or fluid motor without changing internal parts . . .

to have the vanes lie along true radial lines. Also the vane and porting must be symmetrical to achieve the same balance when operating in either direction of rotation.

Small radial passages from inner to outer ends of the vane, Figure 3, provide means for pressure to equalize at all times. The vane is precision cast from hi-speed steel and requires only finish grinding. The vane is undercut on the three seal edges. This undercut permits communication to top and bottom of vane for pressure equalization between the seal lips and also forms two seal lips for each vane. Leakage past the first lip accounts for one-half the pressure drop across the vane and leakage past the second lip accounts for the remaining pressure drop. Experimental tests with pressure taps verified these theoretical principles.

Loading on Vanes

From the pressure distribution diagram, Figure 3, it can be seen that the vane is hydraulically balanced in theory. However, due to possible deflection under load due to clearances and stress in the rotor segment, it is possible for the vane to tilt a small amount. Therefore, the springs were designed to overcome the maximum hydraulic load under this condition which is equal to the pressure, multiplied by the width of the chamfer on the outer sealing edge of the vane, times the length of the vane.

For simplicity of providing a positive displacement fluid motor at low speeds and under stalled conditions helical compression springs were chosen to load the vanes. The vanes are always out and in contact with the cam ring and the motor is ready to work at the instant of the input signal from the pump. During laboratory tests including tests on the first experimental unit, no spring failures have occurred.

Improved Volumetric Efficiency

Experimental tests indicated the need for providing larger porting to take care of the pumping action of the vanes. The small passages through the vane were inadequate to carry the flow.

There are four large primary ports in each housing, Figure 2, two of which are connected to the pipe port. Radially inward and on a smaller radius are four smaller ports. Each small port is interconnected with the adjacent large port by cored passages in the housing castings. These passages permit flow into and out of the space at the bottom of the vane as it crosses port openings. This feature adds to the volumetric efficiency of the unit through the pumping action of the vanes in the rotor slots similar to a radial piston pump and also maintains substantially equal pressures at inner and outer ends of the vane. Pressure balancing relieves hydraulic bearing loads between vanes and

cam ring on the cam rise portions of the ring. The arc length of these primary and secondary ports are such that when the rotor revolves, the outer and inner ends of the vane are exposed to identical pressures at exactly the same time always maintaining radial vane hydraulic balance.

Operation as a Pump

Let us follow through one cycle of the operation as a pump. Figure 2 indicates a unit with rotor revolving counter-clockwise. The position shown is for the instant where two vanes are sealing. As the rotor revolves, a volume is created at the two inlet ports on the vertical centerline. At this time the vane will be moving outward in the rotor slot creating a volume at the bottom of the vane and displacing an equivalent volume at the outer end. Passage ways through the vane and housings permit this pumping action of the vane to counteract itself. Spring load and centrifugal force keeps the vane out in contact with the cam ring. Atmospheric pressure forces oil into the suction ports to fill the volume being created at a constant rate.

At the same time this action is developing at the inlet ports, a reverse action is progressing at the outlet or pressure ports. The volume of oil that was drawn into the inlet port is transported to the position shown in Figure 2 when two vanes again seal, trapping the oil between the vanes and seal it off from the inlet port. This volume of oil on the cutoff portion is not yet pressurized until the bleed slot is uncovered. Flow through the bleed slot and leakage past the sealing vane pressurizes the oil on the cutoff reducing the shock which would occur otherwise.

The oil pressure now being equalized, the vane is forced inward displacing oil from the space at the inner end of the vane which is free to move out and occupy the space created at the outer end of the vane.

Figure 5 shows more clearly the passage means for oil flow to the bottom of the vane.

With this type of porting the vane can be neglected in calculating displacement.

. . . possible developments in the future . . . two pressure, two volume pump-motors . . . units with integral sequence and pressure dividing valves . . . two stage units for operating systems up to 4000 psi.

Fluid Motor Operation

Fluid motor operation is the reverse of the pump operation. If the ports on the vertical centerline are the inlet, oil under pressure will enter and act on the area unbalance of the vanes causing the rotor to turn counter-clockwise. Again the pumping action of the vane is eliminated by communication to top and bottom of the vane. All the vanes are out engaging the cam so no unnecessary loss of oil occurs cross port due to loss of seal. If the unit is used to brake a load it reverts to operation as a pump as previously described. By reversing oil flow to the motor by use of a directional valve reverse rotation is obtained. Because cavitiation normally does not occur in fluid motors they are usually rated to operate at higher speed than a pump unless restricted for other reasons such as rubbing velocity of vanes or bearings.

This article was adapted from Mr. English's paper presented before the Eighth National Conference on Industrial Hydraulics in Chicago, September 5, 1952. The complete paper is being published in the Conference Proceedings.

Fig. 4. Performance curves as a pump.

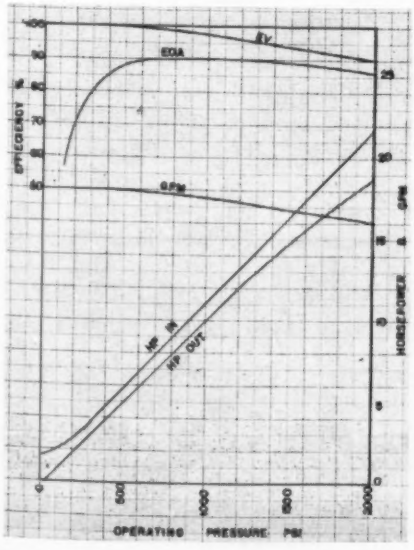
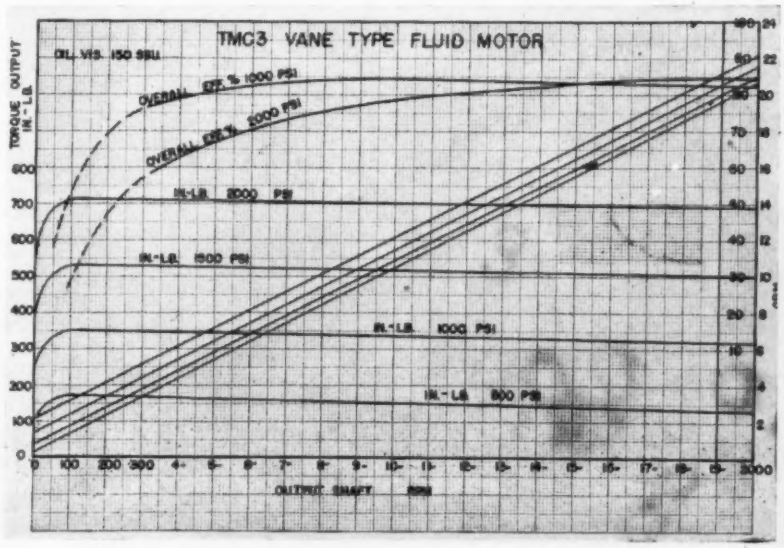


Fig. 5. Performance curves as a motor.



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How Lockheed Trains Technicians For Aircraft Systems

By Herbert P. Boen

INSTRUCTOR HERB BOEN shows the Jet Flight Line Mechanics class the inner workings of a pneumatic safety valve.

LOCKHEED Aircraft Corporation has established an extensive training program to provide skilled systems technicians to meet increased production demands.

In addition to hydraulics and pneumatics, Lockheed's training department provides instruction in electrical check out, rigging, inspection, and flight occupations. At present 30 to 40 trainees complete indoctrination, new skill and upgrade programs in

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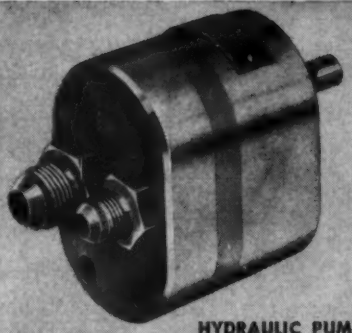

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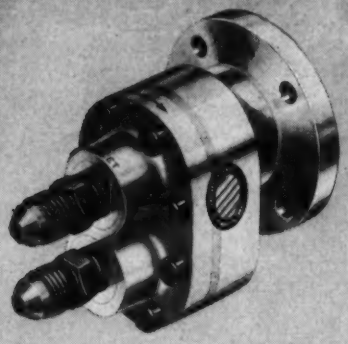

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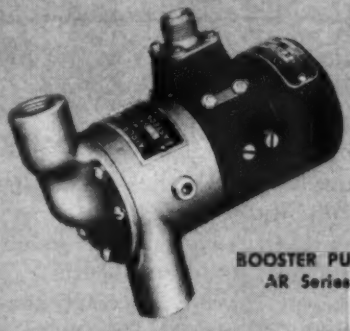

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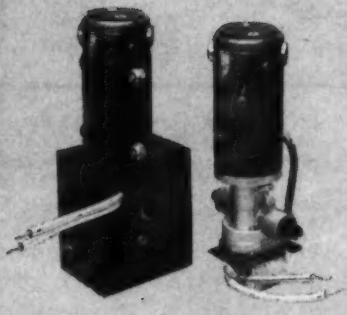

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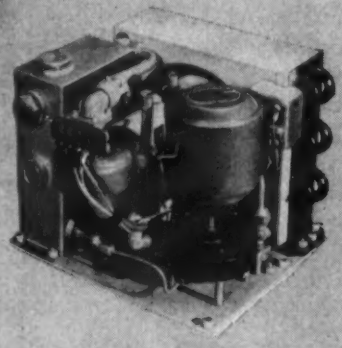
Model 1101-5



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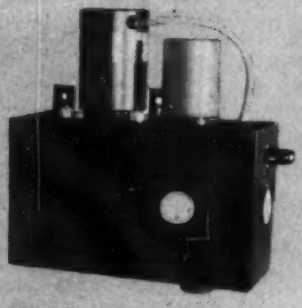

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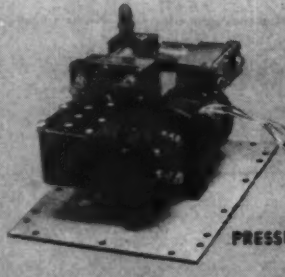

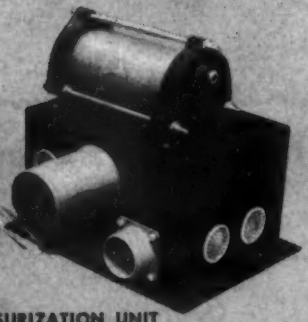

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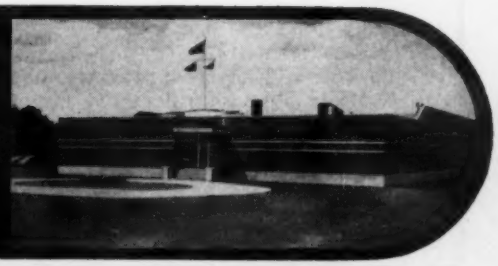

Training In Hydraulics

Hydraulic Principles

Pascal's Law, types of fluids, fluid flow, mechanical advantages and disadvantages.

Elementary Hydraulics

Study of the application of hydraulics to basic aircraft systems.

Energizing Units

Positive displacement, variable displacement, and auxiliary pumps.

Control Valves

Check valves, relief valves, pressure regulators, four-way valves, brake valves, de-boosters, etc.

Articulating Units

Flight control surface boosters, motors, cylinders, brake units, and shock struts.

Miscellaneous

Reservoirs, accumulators, AN Standards and instrumentation.

Hydraulic System

Trainee sketches representative units and systems. Detailed information is given on the particular airplane system the man will be working with.

Inspection and Maintenance

Practical problems in trouble shooting; system failures, and individual unit failure.

systems fields every week. The aircraft systems instruction group numbers seven men, and most classes also hear specialized lectures by representatives from such firms as Allison, Bendix, etc. Motion pictures and a great variety of visual aids are featured. Results reported by production line supervision are excellent.

Emphasis on Basic Skills

More than 2000 men have been trained during 1952. Instructors are selected from veteran Lockheed experts. Average company seniority of the group is more than ten years, and there are 21 various CAA certificates held by the instruction staff. Five of the seven instructors are also pilots.

Emphasis is on giving trainees basic skills they need to work at a new job or a new classification. Trainees are paid at regular rates while they attend training.

Both modern pressurized cabins and hydraulically operated flight control surface boosters, which are Lockheed "firsts," are emphasized in the applicable courses. At present the company is producing the commercial Super Constellation, military versions of the Super Constellation, P2V Neptune Patrol bomber, the recently announced F94C Starfire all-weather fighter, T-33 Jet trainer, YC-130 turbo-prop cargo transport, and several advanced type airplanes still listed as classified by the Navy and Air Force.

Virtually all these airplanes have pressurized cockpits or cabins and hydraulic flight control surface boosters. These systems are closely related to, or interlocking with, many of the ship's other systems. It is desirable that employees assigned to work on these

Training In Pneumatics (Cabin Pressurization)

Pressure Propagation

Mechanical superchargers, turbo-superchargers, and gas turbine compressors.

Temperature Control

Intercoolers, refrigerators, air mixing valves, and heaters.

Safety Devices

Positive and negative pressure relief valves, dump valves and flow control valves, etc.

Systems

Here the trainee sketches components and systems. The system that the man will be working with is explained in detail.

Mechanical systems

Pumps

Control Valves

Relief valves, oil separator, pressure regulator, fusible plugs, distributor valve, selector valve, suction relief valve etc.

Systems

The airplane's system and operation is covered in detail.

Maintenance and Inspection

The trainee is given practical problems in trouble shooting the entire system and its components.

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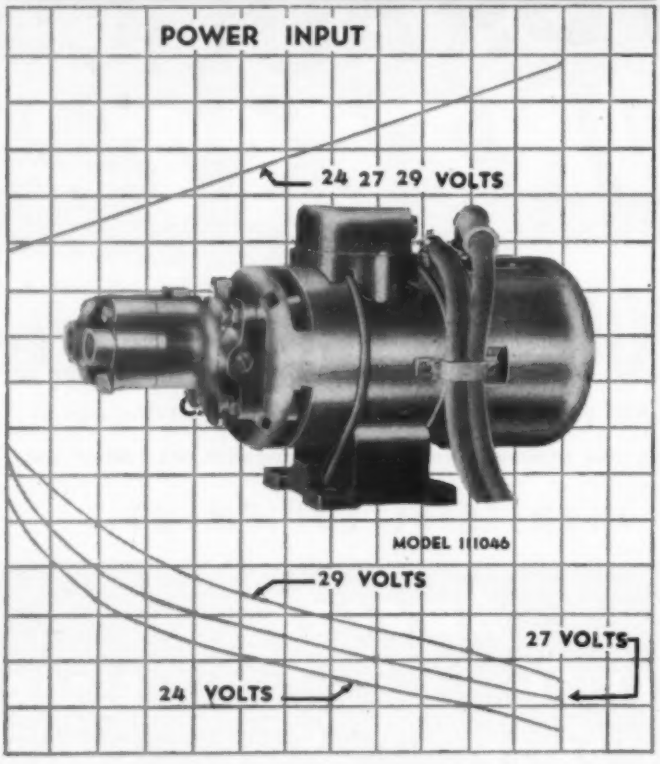

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Lockheed Training

Continued

planes have an appreciation, if not a complete working knowledge, of the hydraulic and pneumatic systems.

Training programs in these fields are designed to be highly flexible and meet requirements of the various Lockheed manufacturing divisions. Advanced classes are made up of mechanics, inspectors, or supervisors or any combination of the three. Basic classes consist of limited experience groups.

Lockheed basic training assumes no knowledge on the part of the trainee since experience has shown that many erroneous basic impressions are held. First step in instruction is to correct these misconceptions, and to reorganize and reorient what pertinent information class members may have.

Class enrollment is held below 15 to allow for participation and effectiveness, but each class has at least 8 trainees for the sake of economy. Employees for advanced classes are assigned to training by their department foreman through a central coordinating office, at least one week prior to the class starting date. In this manner the size of the group can be controlled within the desired limits.

Outlines of material covered in both hydraulics and pneumatics training courses are shown in the accompanying charts. The pneumatic systems are divided into two major sections. Purely mechanical systems such as de-icer or radar pressurization systems and occupant comfort and safety systems such as cabin or cockpit pressurization.

In addition to these systems courses, Lockheed also maintains a fully equipped Service School in which both military and commercial operator's crews are trained. This training may be for any system, or group of systems or for the complete airplane and covers both maintenance and flight operation.

Future Aircraft Developments

Admiral DeWitt C. Ramsey, President of Aircraft Industries Association has predicted that the speeds of the coming series of turbine-powered transport airliners will stabilize in the 500 to 600 mph bracket for 12 to 15 years or even 20 years.

"The next speed increase would have to be in the supersonic range of 900 mph and up," Admiral Ramsey said, pointing out that these supersonic ranges will require an entirely different type of power plant and airframe.

Admiral Ramsey implied that the U.S. should place greater emphasis on the turboprop-type type engine, which appears to have advantages in two different spheres of operations. "Short haul operations of distances between 250 to 700 miles favor the turboprop," Ramsey said, "They are also efficient for long range operation, particularly cargo hauls where greater weight potential rather than high speed is important."

For some years means of charging the machine guns in an aircraft after it is in the air has been needed. Ineffective cable operated mechanisms and heavier more complex power systems have now been replaced by a . . .

Pneumatic Gun Charging System

THE B-1 pneumatic gun charger for firing air cooled 50 caliber machine guns in the production model of a modern fighter plane, the Republic F-84, is the first successful application of its type, utilizing a stepped down pressure from a high pressure airborne compressor.

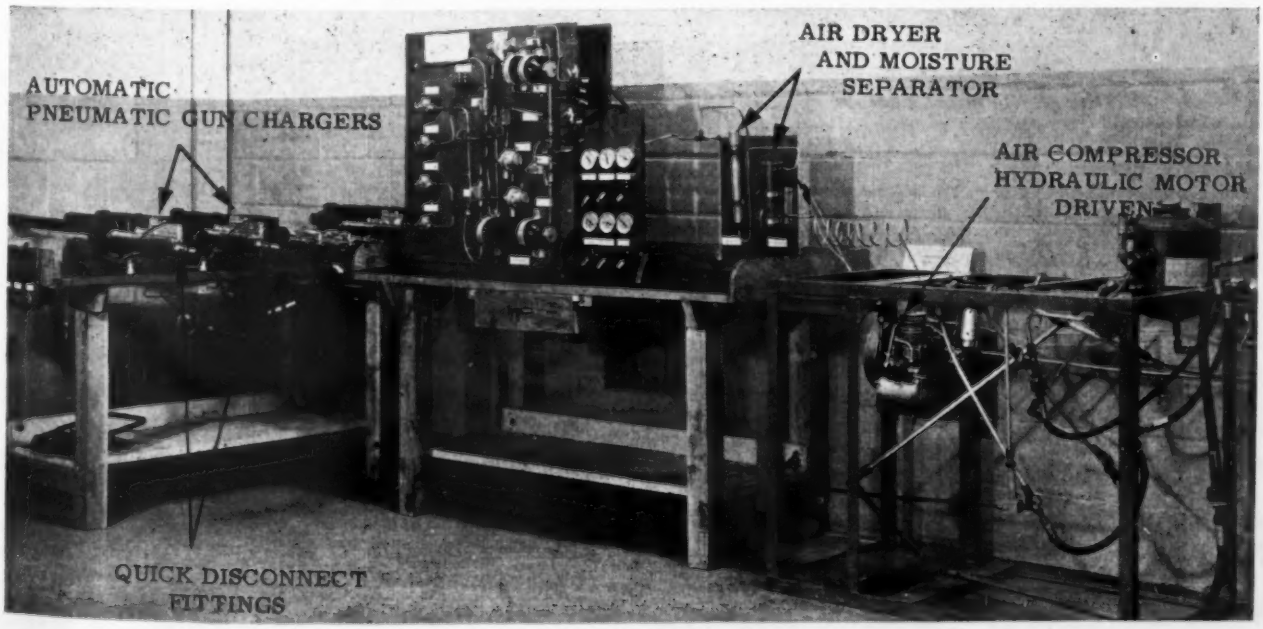
The automatic gun charger is basically a pneumatic piston, spring loaded in the return direction, and a quick disconnect. Designed for use with 800 psi air at a flow rate of 6 cfm of free air, the charger supplies a retracting force of 600 pounds. The complete cycle of the charger at 70° F is approximately 0.8 seconds.

A quick disconnect valve permits shutting off of the air supply quickly without closing a valve or completely dissipating the system pressure. Equipped with a self-contained check, the quick disconnect prevents loss of high pressure air in the disconnect position. Pneumatic fuses and check valves, one in each gun line, protects the system if damaged upstream by gun fire.

Air Materiel Command in 1946 authorized the development of a .50 caliber gun charger to be operated

Mockup of the B-1 pneumatic gun charger and hydraulic drive for the compressor. Components include: on frame at right—hydraulic pump, hydraulic accumulator, hydraulic motor and compressor; on table, center—right panel—air line from compressor to mechanical moisture separator, blow-down or drain pressure valve and chemical air dryer; center, small panel—gauges for testing pressures at six points in system; left, large panel right—50 and 100 cu. in. storage bottles, isolated by relief valves; same panel, center—fuse reset valves (3-way, normally open) live control valve (from 100 cu. in. storage bottle), three pressure reducers (spring loaded diaphragm type); same panel, left—pneumatic fuses, one in each gun charger line; gun table—B-1 automatic gun chargers with quick disconnect fittings (end of breech block); and on side of gun table—triggers for firing the three connected guns.

Courtesy Walter Kidde & Company



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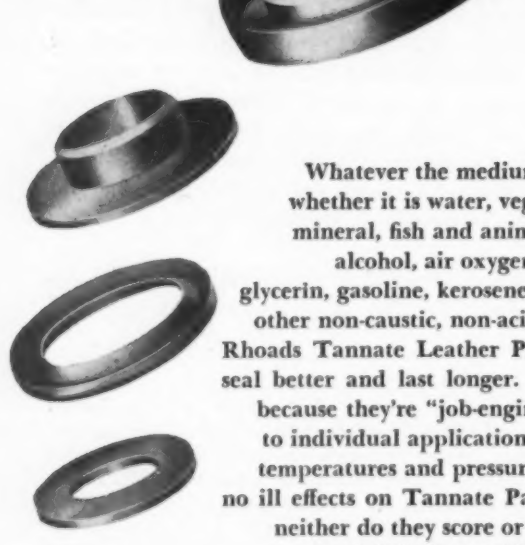

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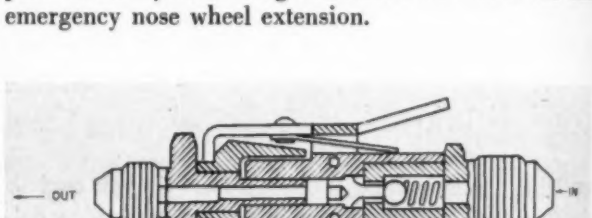
Pneumatic Gun Charger

Continued

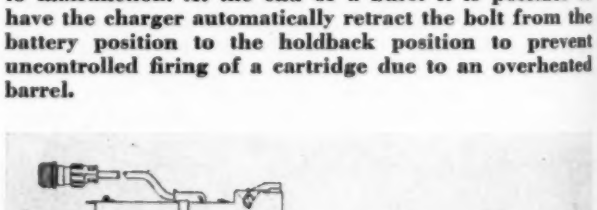
by high pressure air. Pneumatic operation was chosen because speed of operation over the complete temperature range was a prime requirement. Further, it was believed that a pneumatic charger would be simpler and lighter than a hydraulic or electrical charger. The unit was completed and approved in 1950.

A parallel development in airborne compressors, air reservoirs, pneumatic actuators and controls presented an opportunity, in designing the pneumatic system for the F-84, for operating other services. A part of the system being described was used for the emergency nose wheel extension.



To disconnect the air supply without first closing a valve or completely dissipating the system pressure, a quick disconnect valve is installed at the charger. This fitting can be joined or disconnected while under pressure of up to 1500 psi. It is equipped with a self contained check to prevent high pressure air from being lost while in the disconnect position.

The charger provides a means of charging each of the six wing guns on the F-84 either at the control of the pilot or automatically if the gun stops firing due to malfunction. At the end of a burst it is possible to have the charger automatically retract the bolt from the battery position to the holdback position to prevent uncontrolled firing of a cartridge due to an overheated barrel.

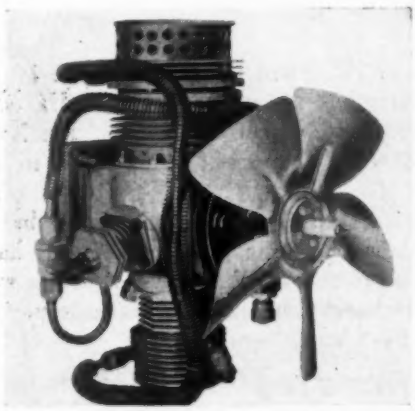


The mockup, illustrated, shows all the elements of the pneumatic system which operates the gun chargers and that part of the hydraulic system necessary to drive the compressor. Three guns and three gun chargers are in the mockup.

The compressor is a four stage, four cylinder radial type, equipped with integral coolers after the first, second and third stages. As installed, the first stage is driven from the crankshaft by a modified scotch yoke; succeeding stages are of free plunger type. The compressor delivers 3000 psi air at a rate of 4 cfm free air at sea level and 1 cfm at 35,000 feet.

A piston type pump drives a hydraulic motor which requires approximately 6.5 gpm at 1150 psi. The compressor is driven in turn by the hydraulic motor at 3750 rpm. A priority valve is inserted in the hydraulic system to starve the compressor drive until the hydraulic operations of higher priority have been completed. The compressor is controlled by a pressure switch which positions a normally open solenoid operated hydraulic selector valve. This valve permits the compressor to operate in the event of electrical system failure.

Both a mechanical moisture separator and a chemical air dryer (latter with replaceable cartridge) are required to meet the AF spec. Moisture trapped by the separator is automatically drained by the blow-



Pressure for the pneumatic system comes from this compressor which measures approximately 11 x 8 x 5 inches. It is a radial, four-cylinder, four-stage, piston-type compressor, weighs approximately 15 pounds, yet delivers four cubic feet of free air per minute (at sea level), at a pressure of 3000 psi.

Courtesy Walter Kidde & Company

down or drain pressure valve when the system is fully charged and the compressor is cutout by the pressure switch.

A check valve just downstream of the chemical drier prevents air being lost from the line leading to the storage bottles when the separator drains.

Two air bottles, cold drawn seamless steel designed to USAF shatterproof requirements and equipped with a ¼ in. adapter, are used; one of 100 cu. in. to supply the gun charge section and one of 50 cu. in for the emergency nose wheel extension.

The fuses (6 in the F-84 system) are set at ¾ cfm free air, closing when subjected to a steady flow greater than this. However, the fuses do not close when subjected to the intermittent demand of the charger. Sufficient air can be trapped in a 16 in. length of ¼ in. OD tubing to provide for 30 operations of the pneumatic sear actuator or 30 bursts from the gun, a number considered more than would be required on any one flight.

The installation of a pneumatic system in the F-84 has aided the use of high pressure air considerably for future applications by supplying design experience; the installation is a proven demonstration that it can effectively perform many vital functions during the flight of an aircraft.

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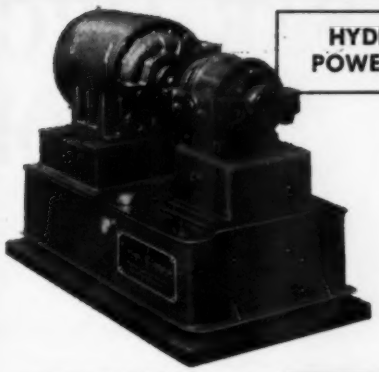

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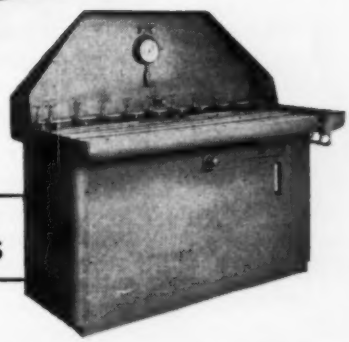

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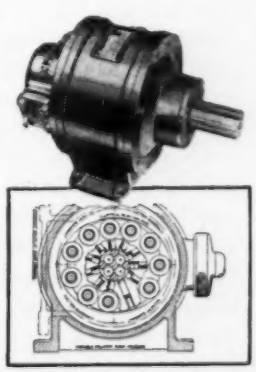

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Report on the SAE AIRCRAFT HYDRAULICS MEETINGS

THE regular semi-annual meeting of SAE Committee A-6, Aircraft Hydraulic and Pneumatic Equipment, held on October 8, 9 and 10 at the Hollywood Roosevelt Hotel, Hollywood, California, attracted the greatest attendance in the history of the Committee. Chairman B. R. Teree announced that 203 representatives of airframe manufacturers, vendor companies and the Services attended the first meeting on Wednesday.

As usual, Fred O. Hosterman, chairman of the Hydraulic System Materials Subcommittee, presided over the meeting to cover materials used for aircraft hydraulic and pneumatic components.

MIL-F-7083 (Aer); Hydrolube H2

The BuAer representative reported that H2 now had 18 months of flight time and that the first difficulty reported by one squadron was excessive corrosion of system components. Inspection indicated that corrosion was limited to dormant areas and where bare steel and aluminum were in contact. Functional parts were not affected unless dormant. The first case reported was in a brake valve, the corrosion being noted between steel springs and aluminum washers. Corrosion was most evident in overhauled components. It was pointed out that par 3.1.1.1.2 of MIL-H-5440 warns against the use of dissimilar metals in metal to metal contact and that par 3.1.1.1 asks for corrosion protection of internal parts not in constant contact with the hydraulic fluid. G. H. Northgery, North American, at the request of BuAer, reported on their setup to correct the corrosion problem.

Chairman Hosterman reported that this problem was discussed at the West Coast Aircraft engineers meeting, held September 18th at North American. Summarized, the recommendations of this meeting were: (1) nonflammable, high temperature, corrosion resistant properties and other requirements common to service aircraft are such that a universal fluid should be used on all airplanes; (2) development work should be continued on a fluid to meet still higher operating temperatures; (3) the development of one fluid to meet all required conditions rather than a few desired conditions. There was agreement on the West Coast recommendations, which will be forwarded to AIA.

Union Carbide was reported as developing a fluid in which the corrosion characteristics appear improved over H2. Swell is reported to be 10 percent in comparison to about 20 percent for H2. More information was promised in 6-8 months. The Navy is preparing to test the Union Carbide fluid in seven airplanes. E. G. See, Douglas, El Segundo, asked if the fluid formula could be made available before tests in airplanes, pointing out that chemists have called attention to the fact that galvanic action would occur with steel and aluminum in contact, especially when traces of salt water were present.

MIL-F-7100

The chairman asked Frank R. Straus, ADC, to report on the status of their fluid testing. Straus reported that preliminary tests have been made on: (1) an organo-phosphate base; (2) a silicone-diester-fluorcarbon base; (3) a brominated benzine base; and (4) a silicate base (also high temperature fluid). Straus reported that the first three came close to all requirements of spec MIL-F-7100.

These fluids were: (1) Monsanto OS-40, which is practically nonflammable and operated satisfactorily from –65 F to 250 F but required butyl packings; (2) Dow Corning XF-408, which was less flammable, operated from –65 F to 300 F and was compatible with present packings; (3) the brominated benzine base was completely nonflammable, operated at from –65 F to 250 F, was readily available and inexpensive, but was not compatible with present packings and had a very high density; (4) the silicate base was less flammable than petroleum oils but was not nonflammable. It operated satisfactorily at from –65 F to 400 F, was compatible with present packings and exhibited good viscosity and thermal stability characteristics.

R. C. McGuire, American Airlines, stated that Skydrol had been used in cabin superchargers in their DC-6's for 18 months with very good results, that lubrication was satisfactory for 2000 hours per overhaul. He pointed out that the principal difficulty was the paint removing characteristic of the fluid and fluid vapor and that buna seals had to be replaced in favor of butyl seals. The latter included butyl liners in hose. He reported that Skydrol leaked through fittings more readily than the standard petroleum fluid.

Frank Murphy, Douglas, Santa Monica, says that no design changes have been necessary since spiral teflon

. . . foaming of hydraulic fluids is . . . primarily caused by mechanical problems

rings were substituted for leather back-up rings to overcome a low amplitude, high frequency packing failure. F. H. Langenfeld, Douglas, Santa Monica, reported on the KLM conversion job, stating that the steps were: (1) change all packings; (2) flush system; (3) coat all wire (except nylon covered) with nylon paint in areas adjacent to hydraulic systems; (4) reinstall all components and test system. He reported that the DC-6 conversion took 1300 hours and added 20-30 pounds in weight.

MIL-0-5606 Oil Hydraulic, Aircraft, Petroleum Base

Paul Hartline, TWA, asked for more information regarding defoaming additives. The discussion which developed indicated that little or no benefits could be expected. D. H. Moreton, Douglas, Santa Monica, reported that foaming is 75-90 percent a mechanical problem.

High Temperature Hydraulic Systems

Frank Straus, ADC, reported that since March a California Research fluid, formula 52742, allegedly good for –65 to 400 F, was being tested in a mock-up system. Some trouble has encountered with a 2 gpm, electric motor driven constant displacement pump in a system with an unloading valve. A variable drive pump at 1000 rpm is giving better results. Another difficulty is the loosening up of filter elements and fittings at high temperature, requiring re-tightening.

ADC is now testing the compatibility of packings with fluid 52742. Three "O" rings of special high temperature materials and one of standard MIL-P-5516 (all rings AN6227) were reported. Solid teflon backups were used in early tests, followed by spiral teflon rings. All rings were cycled 50,000 times at 300 F, the requirement being no permissible leakage. Teflon experienced cold flow but adequately protected the "O" rings. Cycling continued at 400 F, with 50,000 additional cycles as the goal. Breakdowns occurred between 9000 and 23,000 cycles. The MIL-P-5516 ring failed at 18000 but appeared to perform almost as well as the high temperature materials. On all rings there was considerably more extrusion at 400 than at 300 F.

S. E. Sanfilippo, BuAer, suggested a check on opinion concerning the program. After considerable discussion, Chairman Hosterman stated the Subcommittee would consider the matter further and advise the Services.

G. R. Keller, North American, Downey, reported tests at 400 F and plans for even higher temperature tests. Their preliminary test indicated that fluid 52742 was less stable and had a higher viscosity than OS-40, but that the latter had poorer lubricity. "O" rings deformed at high temperatures but continued to seal (but could not be re-installed). His opinion was that compatibility with high temperature fluids, not high

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. . . aircraft engineers urge increase in temperature limits on hydraulic system components

temperature itself, was the major problem. Discussion also developed that the proper selection of size and careful installation of spiral teflon rings is considered as important as temperature for good performance.

In response to a question by Frank Mittell of North American, regarding the part hose manufacturers were playing in the high temperature development programs, Willard Haas, B. F. Goodrich, stated that programs were under way to develop interim materials for 400 F service. Straus, ADC, stated that some work was also being done on a flexible metal hose. Ralph L. Skinner reported on a metal type seal for sealing from –65 F to 800-1000 F.

MIL-P-5516 Packings and Gaskets

Spiral failures of "O" rings were discussed. R. C. McGuire, American Airlines, reviewed the discussion on this subject held in the last SAE Committee A-12, Aircraft Shock Struts. Straus, ADS, reported on reduced squeeze tests on shock struts of two airplanes. Results indicated that closer tolerances gave many more landings per ring. He suggested that on sizes –29 and smaller that tolerances be reduced to plus or minus .004. Ed Cunningham, Precision Rubber Products Corporation, expressed the view that this would be practical. After some discussion, the concensus was that a spec was not needed and the item was dropped.

Back-up Rings

Frank Murphy, Douglas, Santa Monica, stated that he is converting to spiral teflon back-up rings on all moving seals and static seals except that AN 6291 is being replaced only for high temperature applications. He has prepared a proposed list of standard dimensions for spiral teflon back-up rings and proposed that they be made MS standard with required use being optional. R. A. Green, ADC, pointed out that many sizes are in use and that the situation is confused. Harvey Gerwig, Weston Hydraulics, inquired on maintenance, reporting that he found it necessary to put rings on a mandrel, heat and store under pressure. Discussion developed that AMS 3651 is being written to cover performance characteristics of teflon. Action was deferred until results of a NASC survey and the AMS spec become available.

Special Low Friction Seals

R. A. Green, ADC, reported that a development contract had been let to the Bendix Corporation to study friction characteristics of hydraulic seals. A literature survey has been made and a test setup is being designed. Harry Cornish, Douglas, El Segundo, reported that teflon rings used with internal seals, with a small leakage tolerated, developed a friction of only 10 percent of standard seals. He pointed out, however, that

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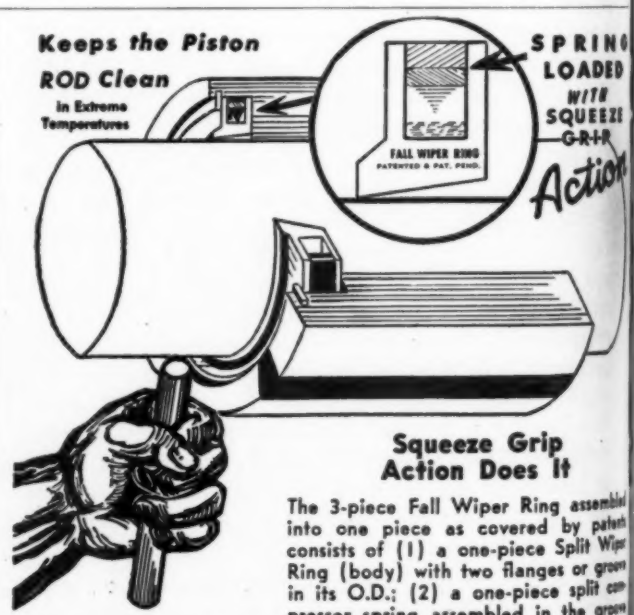

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. . . problems in using titanium
. . . scoring, galling . . .
high friction must be overcome

teflon was unsatisfactory for external seals. A rolling "O" ring, tested in a flight control system, require only approximately one-eighth the energy of a standard application. Frank Mittell, North American, reported that laboratory tests comparing a gland with standard "O" ring and leather back-up rings with standard "O" rings and teflon back-up rings indicated that the latter combination reduces friction 50 to 90 percent.

Materials for Pneumatic Systems

Straus, ADC, reported that the only approved grease (MIL-G-4343) was Dow Corning XG-157A (Pneumatic Grease). This grease is still not available in regular commercial quantities.

Titanium

R. A. Green, ADC, asked for information regarding means for overcoming high friction, scoring and galling of titanium parts used as sliding or threaded members. He cited a case history of high friction encountered in a shuttle valve (titanium shuttle in a titanium bore). Tests are planned for stainless steel and chromium plated shuttles. McDonnell Aircraft was reported as testing titanium pistons in steel and aluminum barrels. Paul Schumacher, Boeing, reported they had been unable to get material. Sanfilippo, BuAer, said that no appreciable progress had been made on their titanium program. Discussion developed the fact that minutes of a recent industry conference on titanium are available from J. R. Long, Minerals and Metals Advisory Board, National Academy of Science, 21 Constitution Ave., N.W., Washington 25, D. C.

AN6293 and 6294, Four-Way Selector Valves

John W. Kelly, Adel, reported on SAE Survey A-6-63 regarding changes in AN6293 and AN6294 shaft ends to eliminate breakage. Comments were generally favorable; the committee accepted the proposed changes.

MIL-P-5518, Pneumatic Systems, Design, Installation and Tests in Aircraft

Al H. Hobelmann, chairman of the Pneumatic Subcommittee of A-6 reviewed the activities of his subcommittee, reporting that proposed specs on general pneumatic components, relief valves and pressure reducers have been released for industry survey. The proposed check valve spec has been awaiting the development of a suitable method of rating check valves. Pollard indicated that such a method has now been revised and that he is revising the spec to include it.

Continued on page 78

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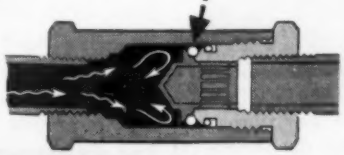

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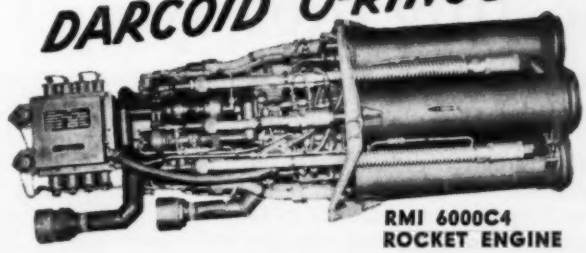

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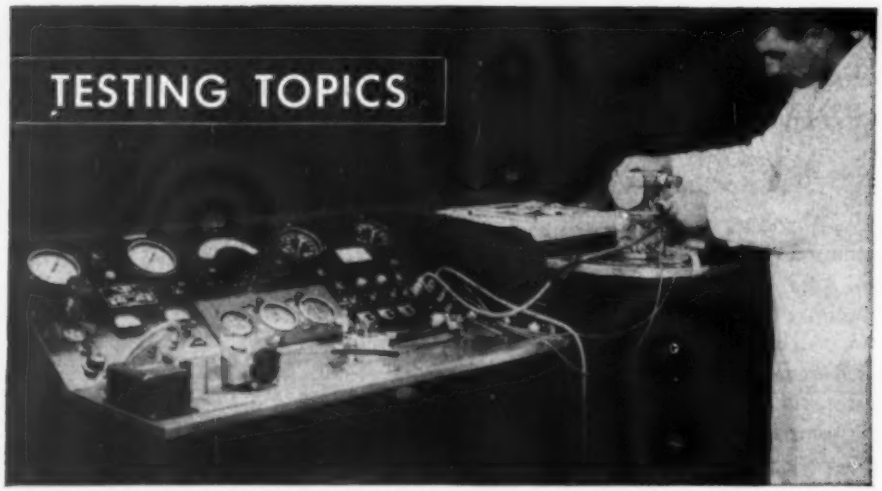

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Second Transport Aircraft Hydraulic Conference

The second annual Transport Aircraft Hydraulic Conference, sponsored by Vickers, Inc., was held on October 28 and 29 at the Park Shelton Hotel, Detroit, with 92 representatives of plane manufacturers, airline operators, parts and materials suppliers. The foreign lines were well represented with three Canadian, one British and seven other international operators being represented. W. E. Spearman of American Airlines acted as chairman of the two day meeting.

With the experience gained from last year's pioneer conference of this type, the agenda was covered in full on schedule, allowing time for informal conferences, the latter being energetically engaged in by most registrants.

Pump and Motor Experience

Airline experience and difficulties with both fixed and variable displacement pumps were discussed. Experiences were exchanged and compared on overhaul limits and costs, parts modifications, including installation and maintenance procedures, bearing types and life. The new motorpump duty cycles were discussed. Several very severe operating conditions were reported. A new proposed MIL spec suggests a 3 minute on 9 minute off cycle.

In the discussion on hydraulic motors, Mid-Continent Airlines reported that motors are now operating 1000 hours to compressor change (MF30) with the new wave washers on type 3913 motors, with units in very good condition at overhaul. United Airlines reported a very noisy motor used to drive the ground cooling fan on the Convair 340. Methods of isolating noise from the airplane structure and interior cabin were discussed.

As in the previous conference, considerable time was spent on the nonflammable fluids. Fluids available from several of the leading suppliers were discussed with case histories of performance given. Sealing problems incidental to specific nonflammable fluids were reviewed. The air entrainment problem in hydraulic fluid AN-0-366 was discussed. TWA reported that a defoaming agent has effectively re-

duced air entrainment and appreciably improved the service life of pumps.

A number of practical problems on hydraulic tube fittings were taken up and airline and airframe experience exchanged. TWA reported very satisfactory results with Ermeto type fittings when installed in steel and aluminum alloy tubing, comparing well with AN flare type fittings. Fluid seepage and leakage problems were given detailed attention, as well as efforts to simplify plumbing connections. Both Capital and Piasecki reported that service experience with Aeroquip self sealing couplings had been very satisfactory.

The discussion on tubing centered around hydraulic failures on new aircraft which experienced line failures due to pin holes in lines, cracks at bends and flare failures. A good deal of discussion was given to the responsibility for inspection by vendors. Pan American Airways, Inc., has been using steel nuts with steel sleeves on stainless steel tubing of ¼ and ⅜ inch diameter for high pressure hydraulic tubing and dural nuts and steel sleeves with stainless steel tubing in ½, ⅝ and ¾ inch diameter sizes. Both TWA and Douglas confirmed and approved the same practice.

The question of titanium for hydraulic tubing and hydraulic component parts aroused considerable interest. It developed that, according to one of the producers, only commercially pure titanium tubing in experimental lots is as yet available. The working characteristics of this tubing approximates that of stainless steel. Titanium bends satisfactorily but it flares poorly as yet. Boeing reported a Navy development contract for testing titanium tubing on fittings but that, to date, they were unable to get the tubing.

One question of considerable general interest was the discussion on the trend in high pressure tubing materials. Examples cited included the Douglas trend toward stainless tubing, Lockheed's present use of 24ST but trend toward stainless and Boeing's trend toward stainless (⅛ hard) tubing.

A more detailed discussion of several of the subjects covered in the Transport Conference will appear in an early issue.

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Design and Application of Flared Fittings

Continued from page 50

tools. Later, an SAE standard covering this same fitting was developed; the dimensional characteristics and other details can be found in the latest issue of the SAE Handbook. The JIC fitting, so-called, is an industrial version of the AN flared fitting.

The characteristics of the fitting and its assembly, uses and limitations are the same as those described under AN fittings. Torque values for assemblies are the same as those shown in previous tables. Additional data for other tubing is listed in Table 2.

Flodar Flared Fitting

One modification has been offered in the sleeve for flared JIC or AN fittings. This fitting, manufactured by the Flodar Corporation, consists of three parts (see Figure 5): (1) a connector body; (2) a tightening nut; and (3) a specially heat treated alloy spring steel sleeve. The sleeve is made in one piece, solid at the forward end (A) and slotted at the rearward end (B). This alloy steel sleeve is interchangeable with the sleeve of the AN fitting.

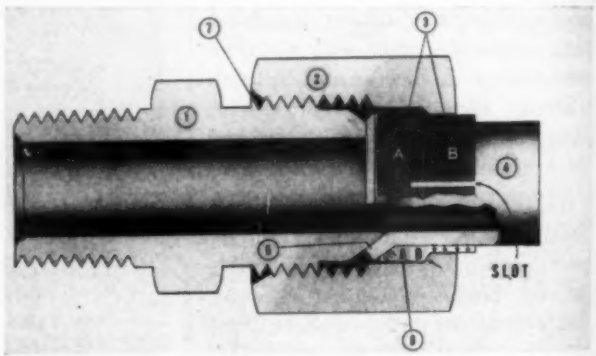


Fig. 5. The Flodar flared fitting is a modified three part JIC or AN fitting. The special one-piece slotted sleeve seals against the flare at the forward end and against the tube barrel at the rear end.

To assemble, the nut is tightened, forcing the solid end of the sleeve against the flare (5) and contracts the segmental fingers of the rearward end (B) against the barrel of the tube, giving a spring, collet-like grip to absorb tube vibration. When tightening, the sleeve will not expand and jam within the nut. A radial clearance is maintained (6) between the nut and sleeve. The method of assembly prevents vibrations or stresses from being transmitted to the base of the flare. This should make the tubing less likely to fail and may give results somewhat better than those obtained with the long nut when severe vibration is encountered.

The next installment, which will appear in the February issue, will begin a discussion of flareless fittings.

Beginner's Course In Basic Pneumatics

Continued from page 54

specific components. These should be used wherever they are available.

One manufacturer of air and hydraulic cylinders has compiled some such data (Table 2). However, this data has been made up primarily for hydraulic use and must be used with caution for air, remembering that hydraulic fluids have a much greater pressure drop per foot of length than does air. However, by using the lower range of equivalent lengths, we have a rough approximation of air pressure loss factors.

With this word of caution, we can use the factors in Table 2. For a ¾ inch, two-way valve, the rough approximation can be obtained by taking the low side of the values in Table 2 or an equivalent of 10 feet. This would make the pressure drop equal to .24 psi (see above for 10 feet of ¾ inch pipe). The cylinder pressure loss would also be .24 psi.

Adding up the pressure losses for Branch No. 1 we have a total of 2.97 or 3 psi pressure loss. Since the initial pressure was 124.7 the pressure at point of use is 121.7 psi.

Branch No. 2

We have already determined the pressure losses of the 2 inch (1 psi) and 1½ inch (1.2 psi) main line runs to the junction of branch No. 2. This gives us an initial pressure for branch No. 2 of 122.5 psi.

The tee through the side outlet for branch No. 2 is the same as for branch No. 1 or .14 psi.

We have 60 feet of 1 inch line in branch No. 2. We determine by formula

$$\frac{.1025 \times 60}{8.3} \times \frac{1.6 \times 1.6}{1.291} =$$

$$.74 \times 1.98 = 1.465 = 1.47 \text{ psi}$$

check by Table 2

$$\frac{217.5}{8.3} = 25.0 \text{ for 1000 feet or 1.5 psi for 60 feet}$$

From Table 2 we find the approximate equivalent of the 1 inch, four-way valve as 25 times the equivalent length of straight pipe or

$$\frac{25.6 \times 25}{1000} = .65 \text{ psi}$$

The cylinder would be approximately half or .33 psi.

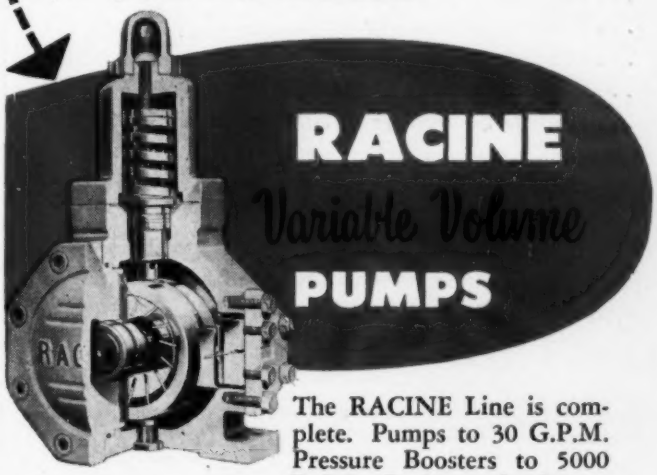
We can now add up the pressure losses for branch No. 2 (see Figure 1). We have a total of 4.86 or 5 psi pressure loss. With an initial pressure of 124.7, the pressure at point of use is 119.7 psi.

The next installment will appear in the February issue. It will deal with moisture in air lines and procedures used to eliminate such moisture.

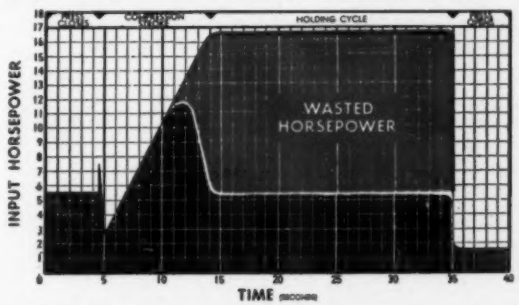
PUT ALL OF THE OIL TO WORK

Simplify the Circuit and Improve Its Efficiency

Use RACINE Variable Volume Pumps; they automatically deliver only the exact volume required. Relief valves are eliminated. Heating is reduced, horsepower saved. Over-all cost of circuit components is less. These advantages are yours when you "put all of the oil to work."



The RACINE Line is complete. Pumps to 30 G.P.M. Pressure Boosters to 5000 P.S.I. Balanced piston sleeve-type 4-way valves, straight-way valves and controls, all designed for manual electric or hydraulic operation. Complete factory and field engineering service without cost. Write for Free, complete 3-color catalog P-10-E. RACINE HYDRAULICS & MACHINERY, INC., 2074 Albert Street, Racine, Wis.



The black area in the chart above shows the H. P. consumed during one complete cycle of operation when a No. 6 RACINE Variable Volume Pump and 7:1 Pressure Booster is used. The colored area shows the wasted additional H. P. required when an efficient 2-pressure, 2-volume Constant Volume Pump of equivalent size is used. Note the savings in H. P. Chart is based on the operation of a 200-ton moulding press with a 10" ram.

BUY DEFENSE BONDS

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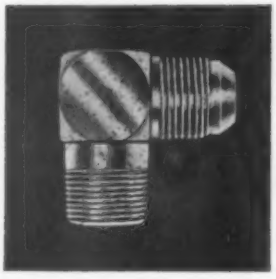
...Ease of Assembly
...Precision Quality
...Large Wrench Flats
...Widest Selection of Shapes and Sizes



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- Variable Length Elbows
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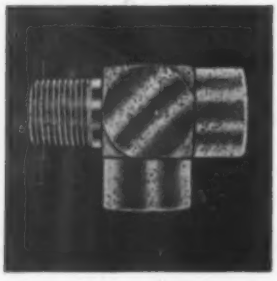
- Bulkhead Straights – Elbows



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- Steel-Bar Stock
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- Dryseal Pipe Threads
- Elbows, Tees, Crosses, Unions, Bushings, and Nipples

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- Restrictor Fittings
- Needle Valves
- Ball Check Valves
- Barbed Hose Stems
- Steel SAE 45° Flare Fittings

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SAE Aircraft Report

Continued from page 73

Pneumatic Relief Valve Specification

Dwight E. Leach, Chance Vought, distributed copies of replies received to SAE Survey A-6-62—the proposed relief valve spec prepared by M. Caserta. Discussion developed the fact that the procedure for setting relief valves was still controversial. However, the majority present favored setting by "cracking pressure". Discussion also developed that a need existed for a satisfactory proof pressure test for pneumatic components. The majority favored proof pressure testing by component manufacturers of parts which may be subject to full pressure. The chairman asked Caserta to revise the proposed spec to include a proof pressure test.

Pressure Transmitters

R. A. Green, ADC, asked for comments by airframe manufacturers on troubles with pressure transmitters. North American reported failures at soldered joints of bourdon tubes, since corrected; Consolidated reported trouble which they attributed to poor installation techniques which caused the hose line to jam the transmitter out of neutral position; Lockheed reported that brazing replaced soldered joints, eliminating their early trouble; Douglas, Santa Monica, reported that the substitution of silver solder for soft solder corrected their trouble. Harry Cornish, Douglas, El Segundo, expressed the belief that remote reading indicators could be dispensed with since they gave no useful information to the pilot, suggesting instead that gauges be directly located. Howard Field, Jr., Consolidated, suggested the use of snubbers and more rugged transmitters.

Tubing and Fittings

Joe Waisman, Douglas, Santa Monica, reported on tests in a fatigue life program, covering both aluminum alloy hydraulic tubing (AMS4083) and stainless steel hydraulic tubing (AMS5566). He reported that the stainless steel tubing offers significant weight savings over the aluminum, 61ST6 tubing. Another significant fact reported was that straight lines have a life of two to ten times that of formed lines.

Harry Cornish, Douglas, El Segundo, stated that their preliminary tests on the cluster type fitting indicated that they were generally satisfactory.

Sanfilippo, BuAer, reported that no progress had been made on the development program on titanium tubing due to the unavailability of titanium tubing.

Because of the pressure of time, neither J. Milton Kidd, Glenn L. Martin, chairman of SAE Committee A-1, Aircraft Pumps, nor Les J. Henderson, Weatherhead, chairman of SAE Committee A-3, Aircraft Flexible Hose Assemblies and Fittings, made their usual report on activities of their respective committees.

Chairman Teree announced that the next meeting of A-6 committee would be held in New York City next April.

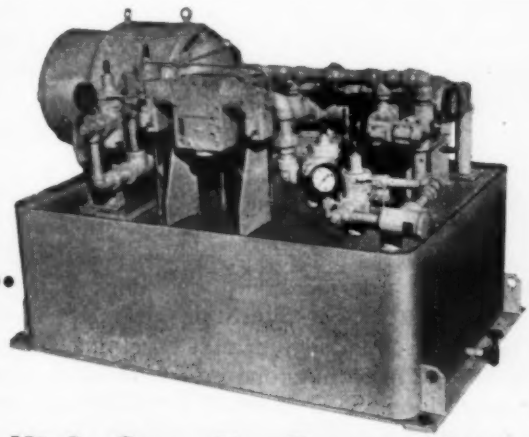
Circle 68 on Reader Service Card

TINY but MIGHTY!

SKINNER STAINLESS STEEL SOLENOID VALVES

...Another case of "a good thing in a small package"! Users are amazed at the ruggedness and unusually large capacity of Skinner Valves—they're tiny but mighty, with a standard range for gaseous or liquid media from 5 to 250 p.s.i., and special from 5 to 850 p.s.i. Their soft insert seat prevents leakage and positive action is assured by spring loading. Skinner Valves may be used in any position, with pipe connections furnished to suit specifications. Power consumption is 10 watts max. Special coils for high humidity or high temperature applications can be supplied. Standard models are approved by Underwriters' Laboratories. *Write for Bulletin No. 501.*

SKINNER ELECTRIC VALVE DIV.
THE SKINNER CHUCK COMPANY
142 Belden Ave., Norwalk, Conn.



High Capacity Power Unit

The photo shows a double pump power unit with a complete set of valves mounted on the cover. The valves mounted include solenoid controlled, pilot operated four-way valve, pressure reducing, sequence and check valves as required for the operation of a bar push pointer such as is used in conjunction with a drawbench. The double pumps are completely unloaded whenever solenoid controlled four-way valve is in neutral position during idle part of cycle.

"HYPECO"
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Custom & Standard Hydraulic Power Units
BOX 431 NORTH LIMA, OHIO PHONE 9-3717
Youngstown Suburb

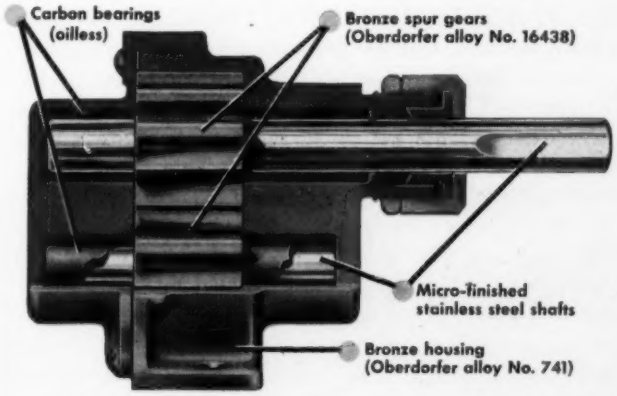
The Low Cost of our pumps is no indication of their Value to You

Do not turn down an Oberdorfer Pump because it is so inexpensive. Look at the facts.

The only way to recognize the best dollar value in pumps is to determine the cost per hour of pump operation – initial cost plus service cost divided by hours of life.

If your pumping requirements are below 150 gallons per minute and under 150 p.s.i., we believe we can beat any other installation on the market on a cost-per-hour basis.

That is why the bulk of American industry has bought Oberdorfer Pumps for so many years – because we have saved them money on pumping costs.


Carbon bearings (oilless)
Bronze spur gears (Oberdorfer alloy No. 16438)
Micro-finished stainless steel shafts
Bronze housing (Oberdorfer alloy No. 741)

The only way to increase pump value is to increase the length of satisfactory service without increasing the price. Oberdorfer Pumps are now available which last five times as long as those we made two years ago, yet cost the same.

Write for a preview of our 1953 production.

See our catalog in Sweet's PRODUCT DESIGN File

OBERDORFER BRONZE PUMPS

Industrial Pump Div., Oberdorfer Foundries, Inc.
5212 Thompson Rd., Syracuse, N. Y.

Please send without charge a copy of your 1953 pump catalog.

NAME_____

COMPANY_____

ADDRESS_____

What's NEW in useful Free literature

To get your reference copies use the postcard bound in this issue.

PRESSURE GAGES . . . A folder describing pressure gauges has been published by the J. E. Lonergan Co. This company manufactures a very extensive line of gauges, some 28 types, more than 100 models and 16 case styles, some of which are included in this folder. The complete line includes gauges suitable for almost any application. The catalog is illustrated, specifications and prices are listed.

Circle 150 on Reader Service Card

HYDRAULIC GREASE FITTINGS . . . A new giant buttonhead grease fitting with one-piece construction is described in a catalog issued by Universal Lubricating Systems Inc. Employing a new design, this fitting is built to provide maximum grease flow. It prevents the leaking possible with conventional two-piece fittings which can be separated by extreme pressure or jolting. According to tests, the one-piece construction imparts stronger longer wearing and abuse resisting qualities. Also featured is a strong inner spring which combines with a fiber sealing washer to prevent grease leak back. The catalog is well illustrated, and includes drain plugs, hydraulic couplers, spring lubricators, control valves, fitting tools and other components.

Circle 151 on Reader Service Card

RUBBER-TO-METAL BONDING . . . Acushnet Process Company has published a supplement to its catalog No. 51, to supply more detailed information concerning the process of rubber to metal adhesion. The process is explained under sctions entitled applications, procedures, design, compounding, process and bond strength ratings. Some of the parts produced are illustrated in this interesting catalog.

Circle 152 on Reader Service Card

FLEXIBLE METAL HOSE . . . A 16-page quick reference catalog CC400, describing flexible metal hose and tubing has been published by The American Brass Co. These products are made in two basic types, seamless and strip wound. The catalog shows a wide range of available alloys and sizes, suggested applications and furnishes data on hose and fittings. General specifications and engineering data are included.

Circle 153 on Reader Service Card

ELECTRICALLY OPERATED VALVES . . . Information on industrial applications of solenoid valves, manufactured by the Atkomatic Valve Co. is now available. These valves are available for pressures up to 3000 psi. Adjustable timing on the closing stroke is available to pressures of 300 psi. This feature eliminates shock on supply lines, particularly on hydraulic operations. The valves are packless, easily maintained, and are designed to handle hydraulic operations, oil, water, steam, air gases and any media not harmful to bronze. Bulletins deal with individual applications such as hydraulic operations, air and gas and show typical operating diagrams.

Circle 154 on Reader Service Card

MAGNETIC SEPARATOR . . . This equipment is designed for the effective removal of abrasive ferrous particles and chips from circulating lubricating systems on machine tools, plant and process equipment, from hydraulic oil lines on hydraulic presses and hydraulic systems of machine tools and from coolant systems on machining operations. S. G. Frantz Co., Inc. has prepared Bulletin 65, providing details on recommended applications, available sizes, capacities and dimensional data to facilitate installation. The bulletin is fully illustrated and includes sectional drawings to show how the units operate.

Circle 155 on Reader Service Card

INDUCTION MOTORS . . . General Electric has published a 12-page catalog describing their Tri-Clad motors, which have been engineered for rugged industrial uses. The Tri-Clad construction means triple protection built into the motor to assure extra protection against physical damage, electrical breakdown, and operating wear and tear. The catalog shows many applications, construction drawings and types available.

Circle 156 on Reader Service Card

HYDRAULIC REMOTE CONTROLS . . . Sperry Products Inc. has issued a series of application data sheets and bulletins featuring remote controls. This control is a self contained system, consists essentially of a hand actuated transmitter and receiver connected by a single tube. There is absolutely no dependency on outside sources of power such as electricity or air which are subject to failures. The system is filled with hydraulic oil and due to the oil's incompressibility, force applied to the transmitter is immediately delivered to the receiver. The data sheets outline all features in detail, drawings and illustrations show construction of the unit, and many application photographs from various industries are included.

Circle 157 on Reader Service Card

SELF LOCKING NUTS . . . a New 26-page catalog has been published by Standard Pressed Steel Co., describing thin lock nuts. The thinner units in many applications can be used to save weight, space and assembly time. Sizes, fits, part numbers, dimensions, tensile values, materials, packing quantities and weights are listed in the catalog for all Flexlocs in both thin and regular design and for aircraft and commercial use. The book is well illustrated.

Circle 158 on Reader Service Card

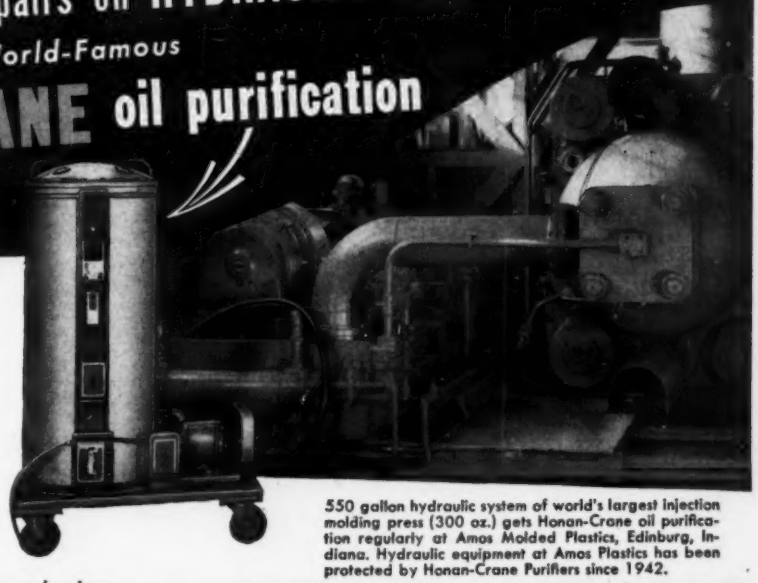
TIMING RELAYS . . . Bulletin 848-852 published by Allen-Bradley Co. features dashpot timing relays, pneumatic timing relays, motor driven process timers and electronic timers. This 16-page two color booklet is very well made up, each section showing illustrations and describing features, applications, adjustments, operations and engineering data. Page one features a detailed article on how to select a timing relay and the factors which should be considered.

Circle 159 on Reader Service Card

HYDRAULIC CYLINDERS . . . Miller Motor Co. has published a new eight page, two color bulletin giving complete engineering, design, construction, mounting and dimensional data of hydraulic cylinders. The bulletin covers 13 different mounting styles in 1½ inch through 12 inch bores with choice of standard leakproof leather cup piston seal or piston ring piston seal or lap fit friction-free precision seal. It describes in detail the leakproof hydraulic rod seal which never requires adjustment. Arrangement and layout of data permits rapid selection of any desired model and bore size, and the obtaining of complete mounting and dimensions for model selected. This bulletin should be a useful addition to a designer's reference file.

Circle 160 on Reader Service Card

STOP downtime, costly repairs on HYDRAULIC EQUIPMENT
with World-Famous
HONAN-CRANE oil purification

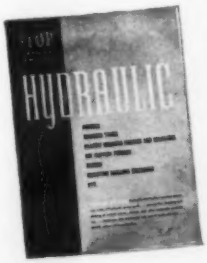


550 gallon hydraulic system of world's largest injection molding press (300 oz.) gets Honan-Crane oil purification regularly at Amos Molded Plastics, Edinburg, Indiana. Hydraulic equipment at Amos Plastics has been protected by Honan-Crane Purifiers since 1942.

70% OF TROUBLE ON HYDRAULIC EQUIPMENT IS CAUSED BY OIL CONTAMINATION AND FAILURE

Honan-Crane Purifiers prevent trouble before it starts in hydraulic installations by keeping oil clean and free from damaging contamination. When used to replace ineffective methods or where no purification program has been practiced previously, 50% reduction in hydraulic maintenance costs and 4 to 5 times the former safe oil life are common experiences.

Honan-Crane Purifiers prevent excessive wear of hydraulic pump parts . . . prevent clogging and sticking of control valves, pistons and other hydraulic mechanisms . . . greatly extend the safe-use life of hydraulic oils. Specify Honan-Crane Oil Purification for your hydraulic equipment. Proven by years of dependable service throughout the world . . . there's no reason to settle for less!



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HYDRAULIC CYLINDERS

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DURABILITY—On all applications Pathon RH Series Cylinders offers you a "Plus Factor" in durability—you get greater fatigue life . . . less maintenance trouble—**and extra capacity for shock loading.**

COMPACTNESS—The use of a single screw thread for attaching heads to barrels, eliminates the bulkiness inherent in keeper-ring and bolt-type cylinders. You get maximum strength in a minimum of space.

Pathon Series RH Hydraulic Cylinders are available in capacities up to 3000 P. S. I.—for special application.
Write for Bulletin #17
The cylinder selector will help you specify the exact characteristic you want in choosing your Pathon Series RH Hydraulic Cylinder Assembly—

PATHON VALVES—We offer you a complete line of Hydraulic Remotely Operated Directional Control Valves.

PATHON PNEUMATIC CYLINDERS — We manufacture seven standard models of Double Acting Air Cylinders which will meet the great majority of your requirements.

HYDRAULIC CYLINDERS—VALVES

Pathon

MANUFACTURING CO.

3821 Pacific Ave.
Cincinnati 12, Ohio

AIR CYLINDERS . . . Lindberg Engineering Company has issued a new bulletin No. 731 covering the complete line of air cylinders manufactured by the company. This 16-page bulletin features diagrams, charts, and photographs explain the six mounting types available. A comprehensive listing of the engineering features and capacity charts are included.

Circle 161 on Reader Service Card

PRECISION SWITCHES . . . Micro, Division of Minneapolis-Honeywell Regulator Co. have just published issue 1 of Mercury Pool, a two-page publication. The current issue features a new mercury switch and also shows how three switches do four jobs. Other items describe useful characteristics and typical samples.

Circle 162 on Reader Service Card

WELDING COUPLINGS . . . Tube Turns Inc. has issued a four page catalog describing the scale free welding coupling. Wherever it is essential that piping connections be free of welding scale and protrusions, this new coupling offers outstanding advantages. The coupling consists of two forged parts with hub ends that match pipe and welding fittings of corresponding nominal pipe sizes. The coupling parts fit together by means of a tongue and groove arrangement that automatically insures perfect alignment. The bulletin shows and describes all features, and also suggests applications, where welding scale, protrusion, pressure losses etc. are recognized problems.

Circle 163 on Reader Service Card

CENTRIFUGAL PUMPS . . . A broad line of centrifugal pumps is outlined in "Handy Guide to Selection of Centrifugal Pumps", a bulletin issued by the Allis-Chalmers Mfg. Co. This diversified line of pumps includes units for handling clear liquid, corrosive or abrasive liquids, or liquids containing large percentages of solids in suspension. Also mentioned are special purpose pumps.

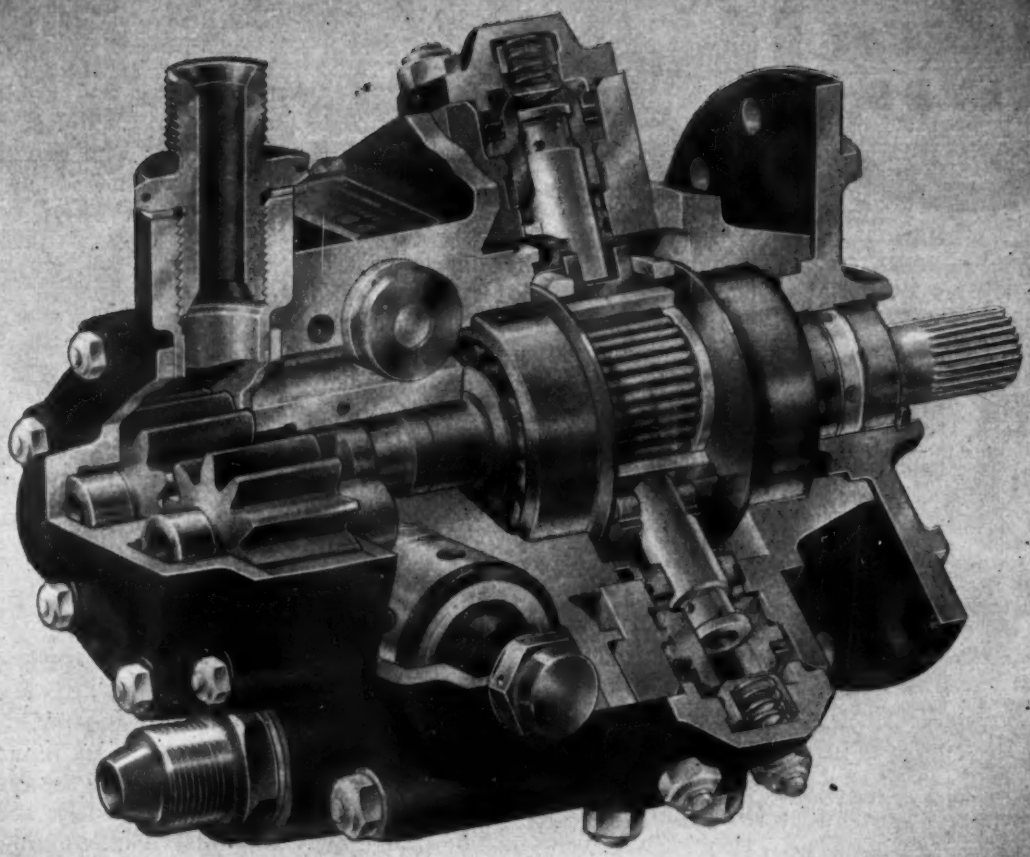
Circle 164 on Reader Service Card

TEST EQUIPMENT . . . Greer Hydraulics Inc. has published an attractive booklet showing test stands for aviation and industry. Some of the units featured are jet engine accessories test equipment, reciprocating engine accessories test equipment, electrical and ignition systems test equipment, hydraulic systems and fuel systems test equipment, and test equipment for propeller systems, lubrication systems and air conditioning systems, as well as universal and combination test equipment. Also featured in this catalog are hydraulic components and accumulators.

Circle 165 on Reader Service Card

Circle 56 on Reader Service Card

DOWTY



Vardel HYDRAULIC PUMP

To meet the demands for increased output under all conditions, this new two-stage type pump delivers 5 Imp. gals/min. at pressures up to 4,000 lb/sq. in. Cut-out and relief valves are self-contained and "flick" pressures virtually eliminated.

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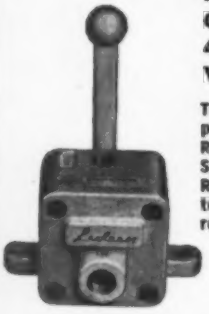
GET THE MOST OUT OF YOUR CYLINDERS with Ledeen VALVES

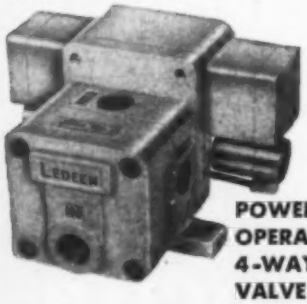


HAND OPERATED 4-WAY VALVE

Three models: Completely Manual—Spring Return to Neutral—Spring Return to Reverse. Flow cycles to handle most requirements.

FOOT OPERATED 4-WAY VALVE

Same as Hand Operated Valve, except foot operation replaces hand. Leaves hands free for other work.



POWER OPERATED 4-WAY VALVE

For remote control, safety or automatic equipment. Suitable for solenoid, cam, finger, toe or hand operation.

Ledeen valves are built in sizes from ⅛" to 1¼" standard pipe tap—to operate air and hydraulic cylinders and motors, single and double acting.

Write for Bulletin 1000

VALVES • CYLINDERS
AIR-HYDRAULIC PUMPS & BOOSTERS
VALVE ACTUATORS • AIR HOISTS

Ledeen Mfg. Co.
1610 So. San Pedro
Los Angeles 15, Calif.

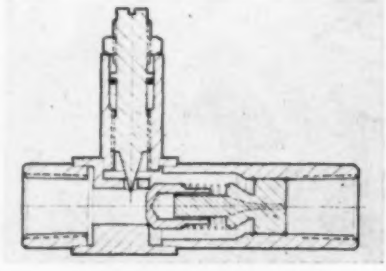
What's New In Components

Continued from page 19

RESTRICTOR VALVES

Fluid Controls, Inc.
Mentor, Ohio

Design: The valve consists of both a check and needle valve. Free flow is permitted in one direction by the check valve, reverse flow closes the check valve and must pass through the needle valve. Adjustment of the latter controls the cylinder speed in one direction only. Flow can be adjusted from a few drops per minute to full



rating without difficulty. Low pressure drop in the free flow direction is obtained by using standard check valve parts. The valves have large seats and ample flow area. Regulated flow is easily adjusted with a standard wrench and screw driver. Burst pressures exceed 10,000 psi.

Application: This adjustable copper brazed, steel body restrictor valve, is designed to regulate the speed of a cylinder in one direction. When speeds in both directions must be regulated, two restrictor valves are used.

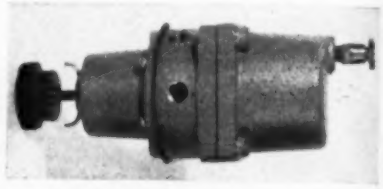
Circle 178 on Reader Service Card

PRESSURE REGULATOR AND FILTER

Minneapolis-Honeywell Regulator Co. Industrial Division, Philadelphia, Pennsylvania

Features: Provides a single compact unit that contains the functions of a dependable reducing-relief valve and a filtering arrangement for line service.

Operation: Line pressures up to 150 pounds per square inch can



be reduced and maintained at any regulated output pressure from 0 to 35 psi without appreciable drift of air consumption. In addition, the filter and dripwell, accessible for easy removal and servicing, assures a constantly clean supply of air for pneumatically operated instruments and similar equipment. With an input pressure of 100 psi, and the output pressure regulated to 20 psi, the unit has a maximum air capacity of about 12 standard cfm.

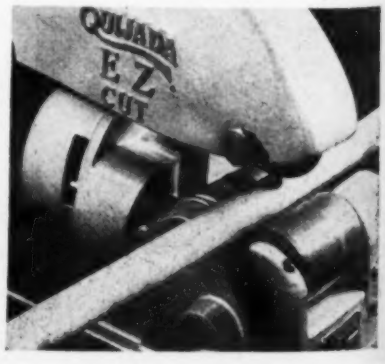
Circle 179 on Reader Service Card

PORTABLE PIPE, TUBE AND CONDUIT CUTTER

Quijado Tool Division of Gaines Collins,
Los Angeles, California

Designation: E-Z Cutters

Features: Ideal for on-the-job cutting. The cutters power driv-



en rollers revolve around the pipe; hence cutting is continuous, slippage is eliminated and the heat treated, high speed tool steel cutter wheel does not wear in one spot so that a single sharpening gives thousands of clean, fast cuts.

Applications: Will handle pipe from ⅜ inch to 2 inches and tubing from ⅝ inch to 3 inches. Adjustable roller type pipe supports allow any length and size of pipe to be cut without changing the supports.

Circle 180 on Reader Service Card

GAUGE SNUBBER

Micro Metallic Corporation
Glen Cove, New York

Features: Pressure snubbers for preventing damage to pressure gauges due to line pulsations

are now treated to keep water out of gauges which are used to measure pressure of air and oil systems.

Operation: Liquid water which is suspended as droplets in a gas or an oil is prevented from entering the pressure gauges by treating, with a suitable silicone material, the porous filter disc which is used to provide the snubbing action. Fine droplets so collected on the filter surface outside of the gauge coalesce and are removed by gravity.

Circle 181 on Reader Service Card

VARIABLE SPEED ELECTRIC POWER DRIVES

Sterling Electric Motors, Inc.
Los Angeles, California

Sizes: Range of 20 to 25 hp with 2-1, 3-1, 4-1 speed variation available in totally enclosed fan-cooled models.

Features: Dual cooling system provides highly efficient inter-

Circle 82 on Reader Service Card

GET THIS BULLETIN

Eight pages, well illustrated, outlining Valvair's unique advantages *for you.*

The bulletin starts thus:

"Valvair air control valves are the expression of an original, exclusive, perhaps ingenious idea in design and construction.

"The objective: To meet virtually countless requirements with fewer types of valves than ever before," etc.

Your letterhead request will be answered promptly.

WHETHER IT'S ORIGINAL EQUIPMENT DESIGN OR CHANGING OVER TO AIR, YOU MAY SAVE ENORMOUSLY BY STANDARDIZING ON . . .

VALVAIRS

Thanks to Diversatility

★ ★ ★

ESPECIALLY ADAPTED TO TOOLING AND FIXTURE DESIGN

★ ★ ★

3-way, knob-operated air control valve.

• Valvair Diversatility is an exclusive, original form of standardization. Five basic bodies permit incorporating any one (or two) control assemblies with a standard valve body. Unique Valvair advantages enable us to speed your order at no extra cost. . . Sizes: ¼" through 1". May we fill your orders *now?*

Get new Bulletin "A-12".

VALVAIR CORPORATION
Affiliate: Sinclair-Collins Valve Co.
951 BEARDSLEY AVE., AKRON 11, O.

REPRESENTATIVES IN PRINCIPAL CITIES

Rely Upon Valvair

DURAMETALLIC
Air Compressor Packings

"The Packing That is Engineered For the Job"

Submit Your Packing or Sealing Problems to Us

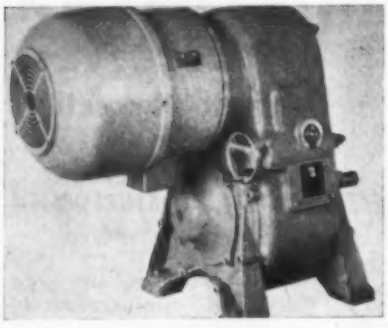
DURAMETALLIC STYLE D-410
AIR COMPRESSOR PACKING

A packing especially developed for air or gas compressors — self-lubricating sealing features insure long uninterrupted service with minimum wear on compressor rods or shafts.

Write Today FOR YOUR COPY OF BULLETIN NO. DMAH

DURAMETALLIC CORPORATION
The PERFECT SEAL
KALAMAZOO, MICHIGAN

nal and external cooling. Air inside the motor is continuously circulated by the large diameter internal cooling fan through unobstructed air passages between the motor housing and stator, over the motor windings, and through openings in the rotor, thereby keeping the circulating air in continuous contact with the motor housing.



Circle 182 on Reader Service Card

Use the convenient Reader Service Card to get more data

✻ Whether heavy-duty or light-duty, high-speed or low-speed, from oil burners and blowers to pumps and agitators, there is a LOVEJOY Flexible Coupling to meet your exact requirements. They offer the best obtainable insurance against alignment troubles —dampen and absorb starting torque, vibration and shock of intermittent loads . . . protect motor and driven machine . . . lengthen bearing life.

LOVEJOY Flexible Couplings are compact in construction, durable, and provide excellent resiliency. Bodies carefully machined. Cushions available in materials suited to the particular load conditions . . . can be changed without shutdown. No lubrication needed.

● *Write today for illustrated catalog with handy selector charts.*

Also Mfrs. of Lovejoy Universal Joints and Lovejoy Variable Speed Pulleys.

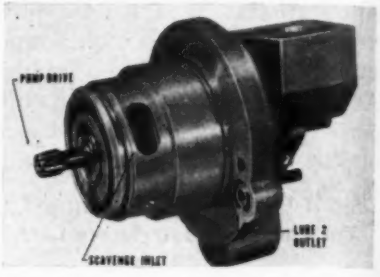
LOVEJOY FLEXIBLE COUPLING CO.

5037 W. Lake St. • Chicago 44, Illinois

PRESSURE AND SCAVENGE LUBRICATING PUMP

Lear Inc., Romec Division
Elyria, Ohio

Designation: Model RG-9830.



Size: The rated capacity of each pressure element is 2.5 gallons per minute and 6 gpm for the scavenge element. Rated speed is 4200 rpm with discharge pressure of 60 psi and rated inlet pressure of 25-30 in Hg absolute.
Design: The pump contains no valves, shaft seals or packings except a shaft seal at the accessory mounting pad to prevent oil leakage. Simplicity of design assures long life with minimum of repair. Total weight is 3.5 pounds.

Circle 183 on Reader Service Card

GEAR-TYPE TUBE BENDER

The Imperial Brass Mfg. Co.
Chicago, Illinois

Sizes: A separate bender is used for each size of tubing and benders are available for tubing from ⅜" to 1⅛" outside diameter (¼" to 1" nominal size).

Features: The high gear ratio makes bending much easier.
Application: The bender is so constructed that it can be posi-

Circle 45 on Reader Service Card

tioned on the tube at any point where a bend is desired. Bends can readily be made even when one end of the tube is connected. It can be used to make right or left hand bends, return bends, offset bends and right angle bends.

Circle 184 on Reader Service Card

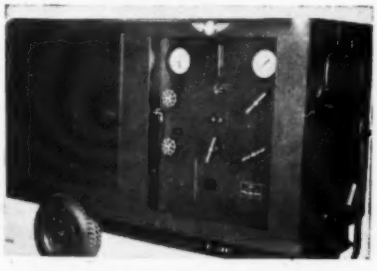
AIRCRAFT TEST STANDS FOR NONFLAMMABLE FLUIDS

Greer Hydraulics, Inc.
Brooklyn, New York

Designation: PE 3C-10VH and PG 3C-10VH for H-2 fluid.

Functions: The H-2 stands are portable and will drain the aircraft hydraulic system, filter the fluid, refill with clean oil, check system performance, check system for leaks.

Design: All components of the system are contained within the



cabinet which is made of angle and channel steel and covered with 16-gage steel panels securely welded or bolted to the frame. Removable panels allow for ease of maintenance and service of the components. The cabinet is mounted on four rubber tire wheels and comes equipped with a tow-bar for towing the machine to the aircraft to be tested. Pressures up to 5000 psi can be developed.

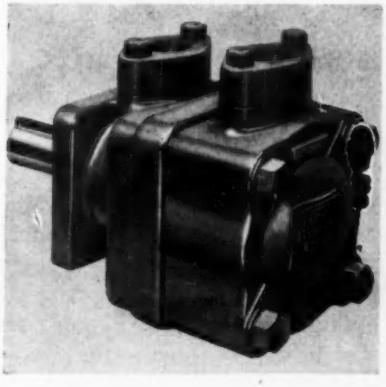
Circle 185 on Reader Service Card

VANE TYPE HYDRAULIC MOTORS

Vickers Incorporated
Detroit, Michigan

Designation: Series M2-200 and M2-500, for 5.0, 5.5 and 26 hp output.

Design: Provides for exceptionally long life at continuing high efficiency and low maintenance cost. An exclusive rocking beam construction keeps all vanes in intimate contact with the cam ring at all times, yet is not subject to the fatigue failure difficulties of spring-type actuators. A combination of low inertia of



moving parts and automatic wear compensation for both radial and axial clearances results in exceptionally high performance efficiency throughout the life of the motor. These motors are unusually compact and of light weight. Mounting adaptability is provided by a choice of four combinations of inlet and outlet port positions, and choice of flange or foot mounting and either direct, belt, chain or gear drive.

Construction: Exceptionally rugged and utilizing heat treated alloy steel for shaft, rotor and vanes, the motors are built to handle the most difficult service conditions.

Circle 186 on Reader Service Card

AIR-HYDRAULIC UNITS

Ledeen Mfg. Co.
Los Angeles, California

Design: Built as a complete package power unit, ready for installation these pumps and power units are available in horizontal construction, for minimum head room, and vertical construction for minimum floor

MORE POWER in less space!

O-M CYLINDERS

air • water • hydraulic

Available in a full range of sizes (1½" to 8" bores), powerful, dependable O-M Cylinders require ½ *less installation space* than conventional type cylinders of equal bore. Tie rods and bulky end caps have been eliminated by a special *Internal Locking* process found only on O-M Cylinders. Saves space . . . provides better balance . . . permits use of more bore power for the job. O-M Cylinders are easy to install, easy to repack. All machined steel with bearing bronze (no castings). Complete range of mounting brackets, interchangeable bore for bore.

14 DAY DELIVERY

Complete standardisation of interchangeable parts and mountings (which eliminate the need for castings and special patterns) speeds production, cuts costs . . . *reduces delivery time to two weeks on nearly all O-M Cylinders.*

Send for FREE CATALOG and Complete Templates

Details and specifications on O-M Cylinders and parts. (Standard, oversize and 2-1 piston rods). ½ scale templates show cylinders and mounting brackets.

MAIL COUPON NOW

ORTMAN MILLER MACHINE CO.

1204 150th Street • Hammond, Indiana

☐ Please send latest O-M catalog.

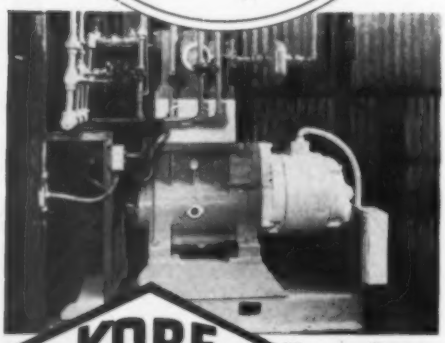
☐ Please send complete set of templates.

Name.....

Company.....

Address.....

City.....Zone....State.....



KOBE Heavy Duty High Pressure

Triplex Pumps

Case History A-13: In 1942 The Buehler Tank and Welding Works, Los Angeles, makers of liquefied petroleum gas tanks and other pressure and non-pressure vessels, installed a Kobe Size 2 Triplex.

8000 psi Required

The pump is used to supply pressure to press cold drawn tank heads of various shapes. Due to the small diameter main cylinder, pressure required is 8000 psi—a pressure unobtainable in ordinary commercial pumps.

"Light Maintenance"

W. P. Buehler states: "The Kobe unit has been in service for 11 years. It has given us very little trouble and requires only light maintenance. We are well satisfied. In fact, so much so that in 1948, we purchased another Kobe unit—a Size 3 Triplex—to supply continuous pressure for our hydraulic assembling equipment."

Triplex Features

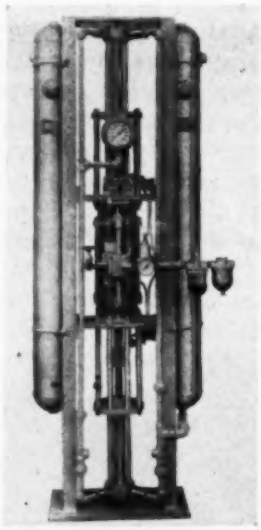
- **Pressures**—To 5,000 psi (standard) To 20,000 psi (special)
- **Volumes**—To 60 g.p.m.
- **Power Ratings**—15, 30, 50 H.P.
- **Integral Double Reduction Gears**
- **Integral Electric Drive (Optional)**
- **Easily interchanged Plungers and Liners**

Write for Bulletin

KOBE INC., Division of Dresser Equipment Co., 615 NBC Bldg., 815 Superior Ave., N.E. Cleveland 14, Ohio

KOBE INC.
Division of Dresser Equipment Co.
Plant: Huntington Park, Calif. — Representatives in CLEVELAND, Pittsburgh, New York, Houston, Oklahoma City.

space. Both pressure and volume are readily adjustable. Normal air pressure is suitable, and very little air is required.



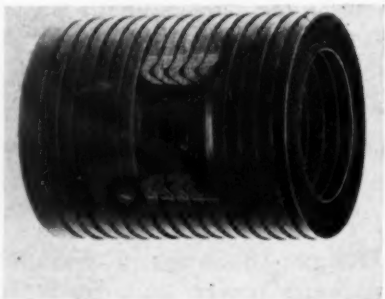
Application: Develops fluid pressure directly from plant air supply and is suitable for operation of high pressure cylinders, clamps, valves, actuators and hydraulic presses; for safety installation and high pressure testing; for special hydraulic circuits requiring variable and adjustable pressure and volume; and for long pressure holding cycles with quick approach without overheating and churning the hydraulic fluid.

Circle 187 on Reader Service Card

"V" PACKING

Periflex, Inc.
Hazel Park, Michigan

Designation: Periflex Set #88.
Design: "V" rings are molded from a special neoprene com-



pound. The convex curve of the internal lip surface allows each ring to function independent of adjacent rings and provides a lubricant reservoir. Increased

MAKE THIS TEST!

Try

PROMET THE Engineered BRONZE

BRONZE PARTS

We know you'll agree that they're by far the highest quality you've ever used. That's why we can offer a

MONEY-BACK GUARANTEE OF LONGER SERVICE AND LOWER MAINTENANCE COST

Many of America's largest pump manufacturers rely on Promet Bronze thrust plates, bearing plates, pressure plates, connecting rods, bushings and seals.

Machined or rough cast and of the specific formula best suited to the application.

Send blueprints, conditions of operation and other data for recommendations and quotations. Write for free literature today.

THE AMERICAN CRUCIBLE PRODUCTS CO.
1303 Oberlin Avenue
Lorain, Ohio

Circle 39 on Reader Service Card

Circle 5 on Reader Service Card

Continued

pressures only tend to increase the efficiency of the assembly. Molded endlessly with no joint. Neither heat nor flexing will cause them to split or fail.

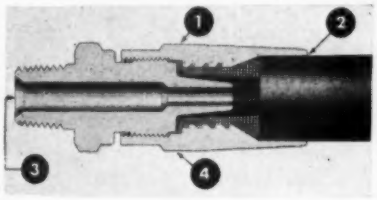
Application: Primarily as rod seal. Also employed as piston seals, length permitting. The new "V" packing comes in rings only—a set consisting of any given number of rings plus male and female end adaptors. Individual rings are available if it is desired to use them with machined metal end members.

Circle 188 on Reader Service Card

REUSABLE HOSE COUPLINGS

Lincoln Engineering Co.
St. Louis, Missouri

Features: Lok-tite positive grip. When core of hose is inserted in sleeve, wire braid is flared and gripped between shoulder and



stud of shelf of sleeve with tremendous clamping force. Faster easier assembly. Bell shaped counterbore of sleeve eliminates difficulty in starting hose into coupling. Wire braid on hose tends to expand on flare. Bell shaped bore engages flared ends acting as a screw, simplifying assembly. Larger volume flow. Extra large flow passage in stud, plus shorter overall length of stud reduces restriction to a minimum. Eliminates hose extrusion.

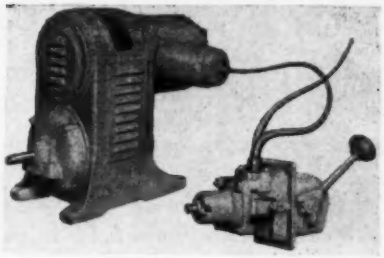
Circle 189 on Reader Service Card

PNEUMATIC REMOTE CONTROL

U. S. Electrical Motors, Inc.
Los Angeles, Calif.

Design: This control consists of a positioning unit—an air operated plunger attached to the varidrive speed changing device and an air valve which remotely controls the positioning unit. Four types of valves are available depending upon the method desired to operate the mechanism—pedal, lever, cam or wheel. The positioning units are designed to operate with an air pressure of either 60 or 100 psi.

Operation: Through the use of check valves and control station selectors in the system, the speed of the varidrive can be



changed from any number of control stations.

Circle 190 on Reader Service Card

Count on
long, uninterrupted service
when you install the water-cooled

WESTINGHOUSE "Z" AIR COMPRESSOR

It's designed specifically for the day-after-day steady pull . . . for the jobs where you can't afford an air supply failure. In fact, every feature of the Westinghouse "Z" is pointed toward uninterrupted operation and long service life.

The single-stage, slow speed operation of the Westinghouse "Z" develops minimum heat that is quickly removed by a combination of water cooling and pressure lubrication. And less heat means less wear.

As additional safeguards, this Westinghouse Air Compressor features low oil level protection, a positive starting unloader and simple, sturdy construction. Vertical design helps fit it into less floor space. Dual control gives you continuous or intermittent operation at the turn of a handle.

Westinghouse "Z" Air Compressors are available in capacities from 80 to 157 cfm; motor sizes from 15 to 30 hp. For complete details, write for Bulletin 9452-11.

INDUSTRIAL PRODUCTS DIVISION
WESTINGHOUSE AIR BRAKE COMPANY
WILMERDING, PENNA.

Circle 88 on Reader Service Card

APPLIED HYDRAULICS

Post Scripts of Industry

News about people, manufacturers and sales organizations

Charles T. Zaoral
The New Air Brake Company

Robert G. Hess
The New Air Brake Company

Lewis K. Sillcox
The New Air Brake Company

Five appointments to top management positions of **The New York Air Brake Company** are announced. **Charles T. Zaoral,** for seven years general manager of the international division of Bendix Aviation Corporation and a director of its subsidiaries in Canada and Australia, will become vice president in charge of operations of the New York Air Brake Company, and was also elected a director. **Lewis K. Sillcox,** formerly executive vice president, has been elected vice chairman of the board. **Robert G. Hess,** formerly president of the company's subsidiary, Kinney Manufacturing Co., has been named manager of the Air Brake's main division at Watertown, New York. His successor at the Kinney organization will be **R. H. Mitchell,** formerly assistant to the vice president. **Frederic W. Hewes,** treasurer and assistant to the president of the parent company, has been elected vice president in charge of finance.

John R. Markey has been named assistant to the vice president of **The Aro Equipment Corporation** of Bryan, Ohio. Also announced was the appointment of **A. N. Abelson** as vice president in charge of manufacturing. Formerly general manager of the Cleveland plant, he will now be responsible for all production at both Bryan and Cleveland. Earlier this year he had been promoted to general manager of the Cleveland plant.

Harvey H. Morrison has joined **Stillman Rubber Co.,** 5811 Marilyn Ave., Culver City as vice president in charge of production. Morrison was formerly vice president in charge of production, Los Angeles Standard Rubber Co., for five years and for four years factory superintendent, Plastic and Rubber Products Co.

Appointment of **R. R. Harrison** as assistant chief engineer and **Bruce MacDonald** and **B. E. McNay** as senior project engineers was announced by **The Rucker Company,** Oakland, Cal.

The appointment of the **Korhumel Steel and Aluminum Company** of Indianapolis, as distributor of industrial tube fittings, tube tools and O-rings manufactured by the **Parker Appliance Co.,** was announced. **Lewis C. Ely** and **J. J. Matich** have been appointed industrial sales engineers for the Parker Appliance Company. Ely will cover the Southeastern states with headquarters in Atlanta and Matich with headquarters in Indianapolis will cover the state of Indiana, and Louisville, Kentucky.

In a move to further diversify its manufacturing operations **H. K. Porter Co. Inc.,** Pittsburgh, has acquired **The Watson-Stillman Company,** Roselle, N. J., manufacturers of forged steel fittings and hydraulic equipment.

why HANNIFIN series "N" cylinders are the recognized standard of the hydraulic industry

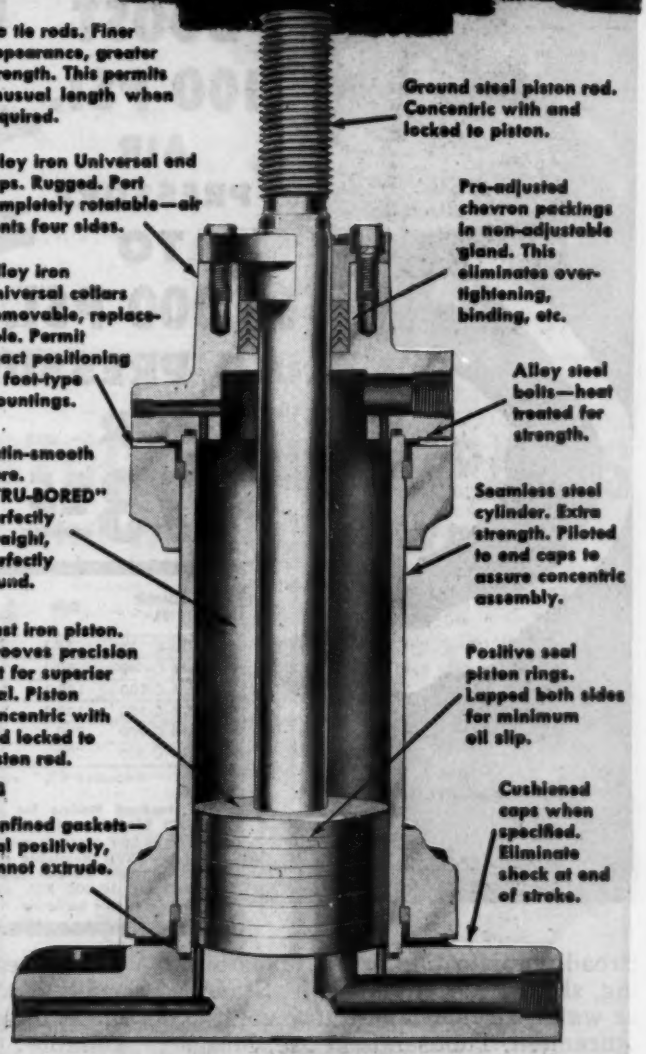
THE MOST COMPLETE STANDARD LINE

Hannifin is your single source for the broadest standard line of hydraulic cylinders on the market. When you need hydraulic cylinders, you'll save time and money by selecting from the complete Hannifin line.

- 12 bore sizes, 1" to 8"
- 11 standard mountings—more than 65 combination mountings
- No tie rods; ideal for long-stroke applications
- Cushioned and non-cushioned
- Double end piston rods available in most styles
- Bodies of heavy-walled steel tubing "TRU-BORED" and honed

WRITE FOR BULLETIN 110
Complete specifications and dimensions

DESIGNED AND BUILT FOR SUPERIOR PERFORMANCE LONGER LIFE


No tie rods. Finer appearance, greater strength. This permits unusual length when required.
Ground steel piston rod. Concentric with and locked to piston.
Alloy iron Universal end caps. Rugged. Port completely rotatable—air vents four sides.
Pre-adjusted chevron packings in non-adjustable gland. This eliminates over-tightening, binding, etc.
Alloy iron Universal collars Removable, replaceable. Permit exact positioning of foot-type mountings.
Alloy steel bolts—heat treated for strength.
Satin-smooth bore. "TRU-BORED" perfectly straight, perfectly round.
Seamless steel cylinder. Extra strength. Piloted to end caps to assure concentric assembly.
Cast iron piston. Grooves precision cut for superior seal. Piston concentric with and locked to piston rod.
Positive seal piston rings. Lapped both sides for minimum oil slip.
Confined gaskets—seal positively, cannot extrude.
Cushioned caps when specified. Eliminate shock at end of stroke.

HANNIFIN

HANNIFIN CORPORATION • 1155 S. KILBOURN AVE., CHICAGO 24, ILLINOIS

AIR AND HYDRAULIC CYLINDERS • HYDRAULIC POWER UNITS • PNEUMATIC AND HYDRAULIC PRESSES • AIR CONTROL VALVES

Circle 29 on Reader Service Card

Appointment of **E. E. Schaffer** and **E. E. Williams** as staff engineers was announced by **The Harold F. Howard Company,** Detroit, industrial and management consulting firm.

The **Denison Engineering Company** of Columbus, Ohio, has opened a branch office at 4306 West 63rd Street, Chicago 29, to serve Chicago and environs and also to headquarter the company's central regional supervisory office. Serving as manager of the branch will be **Melvin G. Sulser,** who has been with the company since 1941. Assisting him will be the following field engineers: **Leonard J. Freeman** and **Larry S. Huneck** for the Multipress Division, and **Carl H. Scheuerman** and **Leo S. Conkel** for the Pump and Control Division.

Templeton, Kenly & Co., Chicago, has consolidated its New York domestic and export offices. **E. A. Zimmerman** will direct both operations in the new quarters at 60 East 42nd Street, New York.

All property of the **LaPlant-Choate Manufacturing Company,** Cedar Rapids, Iowa, was officially acquired by **Allis-Chalmers Manufacturing Company,** Milwaukee, Wisconsin, which started operating as the **Cedar Rapids Works of the Tractor Division. A. D. Dennis,** president of La Plant-Choate is general manager, **Wallace Gates** is works manager and **H. W. Rockwell** is chief engineer. Both of these men held the same positions in the LaPlant-Choate organization. Cedar Rapids Works products will be sold and serviced through Allis-Chalmers dealers.

Robert D. Schliem has been advanced to chief inspector for the **C. A. Norgren Co.** Mr. Schliem is trained in mechanical engineering and has served in the process engineering department of the pneumatic products manufacturing concern.

Howard J. Evans
Rockwell Manufacturing Company

The appointments of **Howard J. Evans** as chief engineer and **Robert J. Sarraf** as chief chemical engineer have been announced by **Rockwell Manufacturing Company's** Meter and Valve Division. Sarraf will be assisted by **L. M. Van der Pyl,** chief chemist.

SPRAGUE HYDRAULIC BOOST PUMPS

BOOST 100 PSI. AIR PRESSURE TO 10,000 PSI. FLUID PRESSURE FOR $173.25

Assembly No.	Ratio	Maximum Fluid Pressure	Prices, F.O.B. Gardena, California
216-C- 35	35:1	3,500 PSI.	$173.25
216-C- 60	60:1	6,000 PSI.	$173.25
216-C-100	100:1	10,000 PSI.	$173.25
216-C-150	150:1	15,000 PSI.	$194.50
216-C-200	200:1	20,000 PSI.	$225.00
216-C-300	300:1	30,000 PSI.	$289.50

Measures 8¼" wide x 9⅝" deep.

Six standard Models for output fluid pressures to 30,000 PSI. from 100-150 PSI. plant-supplied air pressure. Low pressure models in ratios of 1:1, 4:1, 10:1 and 20:1 available on special order. (Widely used for fluid transfer applications). High pressure models, to 50,000 PSI. also available on special order. Send for bulletins.

Broadly applicable for static testing, powering presses for metal forming, shearing, clamping, etc. Standard models available for either oil or water service, where low volume output at high pressure is the requirement. Thousands in use. Simple... Reliable... Inexpensive.

Representatives — New York, Tiverton, R. I., Philadelphia, Cleveland, Dayton, St. Louis, Chicago, Logansport, Wichita, Dallas, Houston, Denver, Seattle. CANADA — Exclusive Distributor: Rousseau Controls, Ltd., Montreal Airport, P. Q.

1144 West 135th St., Gardena, California

SPRAGUE Engineering and Sales Corp.

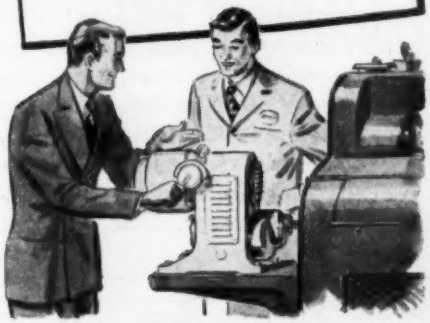
F. C. Messaros
American Engineering Co.

H. Pagels
American Engineering Co.

American Engineering Company, Philadelphia, announces the appointments of **H. Pagels** as vice president in charge of manufacturing, and of **F. C. Messaros** as vice president in charge of engineering.

Dr. John McGavack has been appointed technical director of the plantation division of the **United States Rubber Company.** He succeeds **Dr. E. M. McColm** who is transferring to research and development work at the general laboratories in Passaic, N. J. In his new position, Dr. McGavack will direct the plantation division's research and development work. **Purdy Miller** has been appointed manager of molded goods sales, and will make his headquarters in Passaic, N. J. He was formerly assistant manager of the Chicago Branch. **Henry W. Willard** has been named factory manager of the Passaic plant, succeeding **Wiliam C. Bowker,** who has retired after 47 years of service with the company.

MACHINE BUILDERS:
SELL YOUR PRODUCT FASTER WITH VARIABLE SPEED

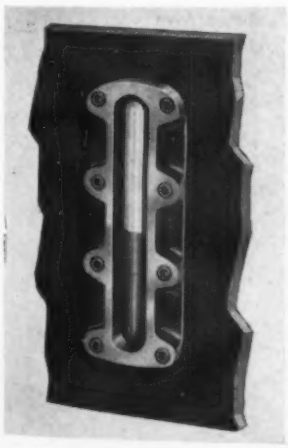


U.S. VARIDRIVE

Ask for Bulletin

U.S. ELECTRICAL MOTORS, Inc.
Box 2058, Los Angeles 54, Cal. or Milford, Conn.

Demand the best...use CENTURY accessories!



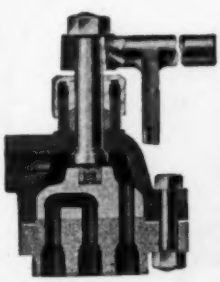
← For new or modernization of old reservoirs use CENTURY designed and built Sight Oil Level Gages.

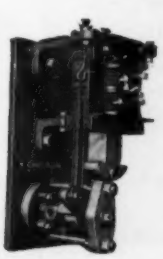
Get the best. Use CENTURY designed Filler-breather Cap assemblies for all your reservoirs. →

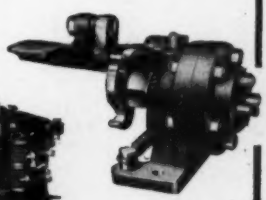
CENTURY HYDRAULICS, INC.
18135 JAMES COUZENS HIGHWAY • DETROIT 35, MICHIGAN

YOU CAN
STOCK FEWER SPARES
with NICHOLSON VALVES

Because Nicholson cylinder control valves are suitable for all mediums, they offer maximum use for interchange and replacement purposes. Unlike many poppet or balanced-piston valves, they can be used for steam as well as air, gas, oil or water. A prominent rubber firm reports they carry only one spare valve for each 52 in service. Larger choice of metal combinations also a Nicholson feature.







Foot models (above), ¼" to 1½", pressures to 300 lbs.

Lever models (left), ¼" to 2½", pressures to 5000 lbs. Solenoid (right) and motor types, ⅛" to 2½"; pressures to 375 lbs.

Cat. 552

213 Oregon St.
Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.
TRAPS · VALVES · FLOATS

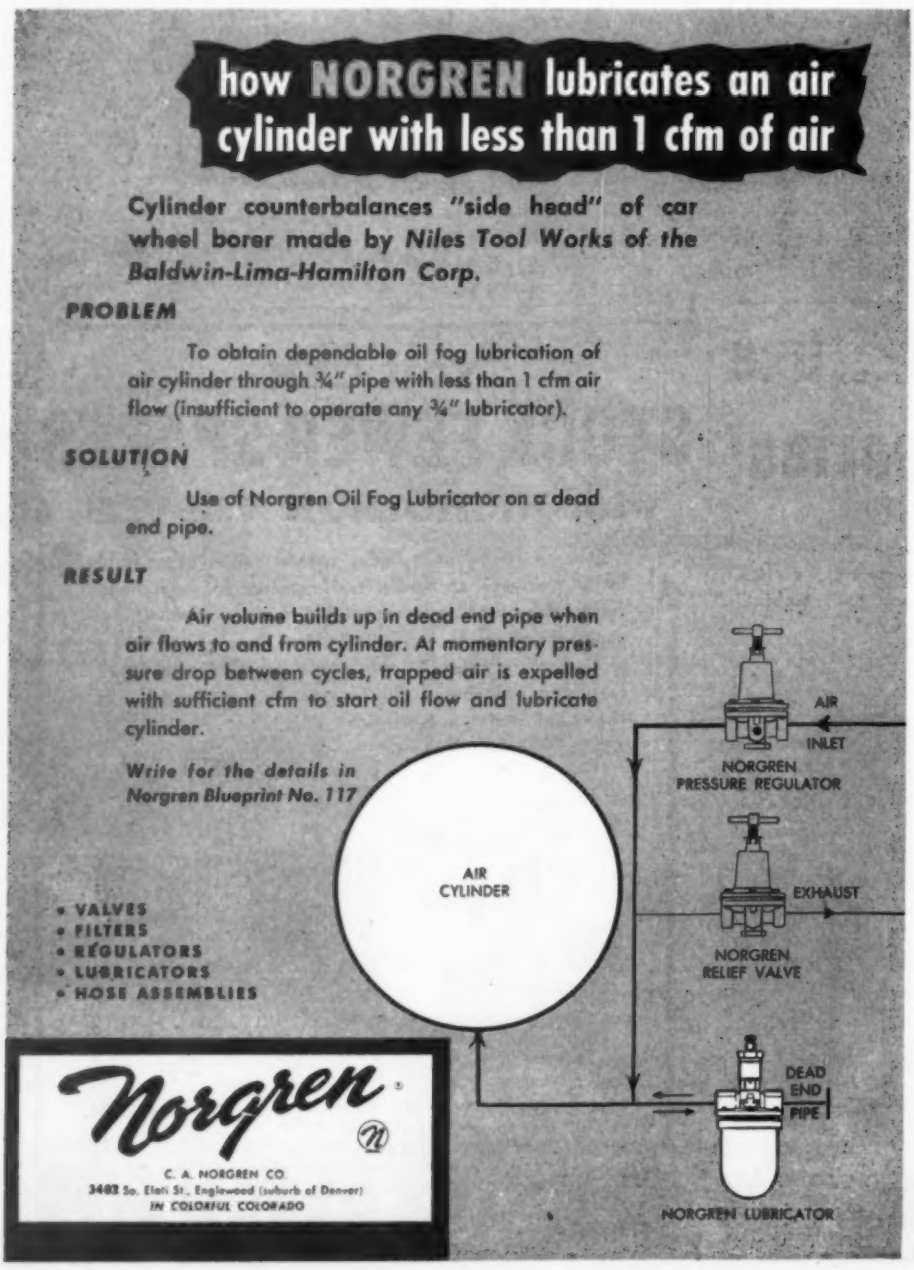
Babcock and Wilcox Company has opened a district sales office in Syracuse. **J. Y. McCandless** has been appointed in charge of the new office which will be located at 205 Harrison Street, Syracuse, N. Y.

Quijada Tool Division of Gaines-Collins, Los Angeles, has appointed two additional district managers. **Jack Nathan** has been named Eastern district manager, with headquarters located at 590 West End Avenue, New York. **J. Jay Smith** has been appointed Central States district manager. The address is P. O. Box 182, Glen Ellyn, Illinois.

Landon C. Fuqua has been appointed sales representative and assigned to the Chicago office by **Standard Pressed Steel Co.**, Jenkintown. The Chicago district offices are at 320 South Jefferson Street.

Worthington Corporation has announced the promotion of five engineers. **John E. Lancaster** has been appointed assistant chief engineer of the air conditioning and refrigeration engineering division. **William C. Osborne** has been appointed manager of the research and development department. **Norman L. Meyerson** has been appointed assistant manager of the research and development department. **Frederick C. Gillman** has been appointed research engineer and **T. A. Herman** has been appointed assistant chief engineer of the reciprocating engineering division.

Mechanical Air Controls, Inc. has announced the appointment of **Neff Engineering Company**, 2611 West Drive; Fort Wayne, Indiana as the exclusive representative for the entire state of Indiana. Branch sales and service offices are now established in Indianapolis and South Bend to better serve the Southern and Northern sections of the state.


how NORGREN lubricates an air cylinder with less than 1 cfm of air
Cylinder counterbalances "side head" of car wheel borer made by Niles Tool Works of the Baldwin-Lima-Hamilton Corp.
PROBLEM
To obtain dependable oil fog lubrication of air cylinder through ¾" pipe with less than 1 cfm air flow (insufficient to operate any ¾" lubricator).
SOLUTION
Use of Norgren Oil Fog Lubricator on a dead end pipe.
RESULT
Air volume builds up in dead end pipe when air flows to and from cylinder. At momentary pressure drop between cycles, trapped air is expelled with sufficient cfm to start oil flow and lubricate cylinder.
Write for the details in Norgren Blueprint No. 117
• VALVES
• FILTERS
• REGULATORS
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AIR CYLINDER
AIR
INLET
NORGREN PRESSURE REGULATOR
EXHAUST
NORGREN RELIEF VALVE
DEAD END PIPE
NORGREN LUBRICATOR
Norgren
C. A. NORGREN CO
3402 So. Elati St., Englewood (suburb of Denver)
IN COLORFUL COLORADO

Carl P. Brown
Kobe Inc.

Carl P. Brown has been named manager of Industrial and Export Sales of **Kobe Inc.**, Division of Dresser Equipment Co. He has been transferred to the new post, in Cleveland, Ohio, from Houston, Texas, where he was area service manager for the company's hydraulic sales department.

The appointment of **Kenneth R. Blaisdell** as field engineer in the Springfield, Massachusetts territory, by **The Bellows Co.** is announced. Blaisdell has a varied and practical experience in engineering design, production engineering and industrial sales.

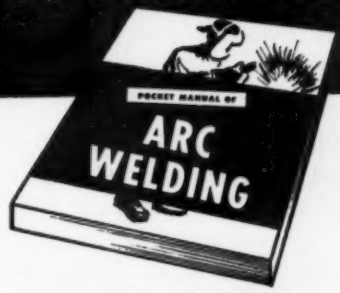
Kenneth R. Blaisdell
The Bellows Co.

D. J. Jones
Honan-Crane Corporation

The **Honan-Crane Corporation** has announced the appointment of **D. J. Jones** as general sales manager. Jones has been associated with the company since 1943. He will direct sales activities from the Honan-Crane home office in Lebanon, Indiana. Mr. Jones is a graduate mechanical engineer from the University of Nebraska.

In line with the **R. M. Hollingshead Corporation's** current expansion and re-organization of its executive staff, **A. E. Moore, V. M. Mantz** and **Dr. V. Esposito** have been appointed to new positions in the firm's research and development division. A. V. Moore has been appointed vice president and director of research and development and will be in charge of all matters pertaining to the direction of Hollinghead's laboratories. V. M. Mantz has been appointed director of Government and industrial research, and Dr. V. Esposito, formerly assistant director, now becomes director of new products, suc-

Here's a new book YOU should have



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An Easy-to-use Reference Manual

Provides necessary one-the-spot information about many every day Arc Welding problems.
Contains 172 pages of practical welding data of value to department heads, supervisors, inspectors and welding operators.
Single copies $1.25 each. Special discounts on orders of 25 or more. Attach check or money order to coupon below.

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Check or Money order for $.....is attached. Please send me.....copies of your POCKET MANUAL OF ARC WELDING
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The Higher the Pressure ...the Tighter the Valve

On hydraulic presses of all types this Yarway Hydraulic Valve will give long life with minimum maintenance. Automatically regrinds its own sealing surfaces. Small and compact. Easy to install and operate.

Yarway Single-Pressure Hydraulic Valves are made in straightway, three-way and four-way types; in five sizes for pressures up to 5000 lbs. Also Yarway Two-Pressure Valves in two sizes for pressures up to 5000 lbs. Write for Bulletin H-210.

YARNALL-WARING CO.
155 Mermaid Ave., Philadelphia 18, Pa.

YARWAY
Improved Type
HYDRAULIC VALVE

IT PAYS TO
INVEST IN PROTECTION

Send for Descriptive Literature

HANNIFIN "Air Warden"

Hannifin "Air Warden" safeguards against loss of production time—protects your valuable air-operated equipment three ways.

1. **AIR FILTER**—removes grit, dirt, scale, moisture, emulsified oil.
2. **PRESSURE REGULATOR**—keeps pressure where you want it. No danger of pressure build-up with "Air Warden."
3. **LUBRICATOR**—atomizing type lubricator, can be filled without shutting off air pressure.

Sold separately or in combination (as shown).

HANNIFIN

HANNIFIN CORPORATION, 1155 S. Kilbourn Ave., Chicago 24, Illinois

ceeding Moore. **J. W. Woodward** has resigned as a research engineer with North American Aviation to become West Coast representative for the R. M. Hollingshead Corp.

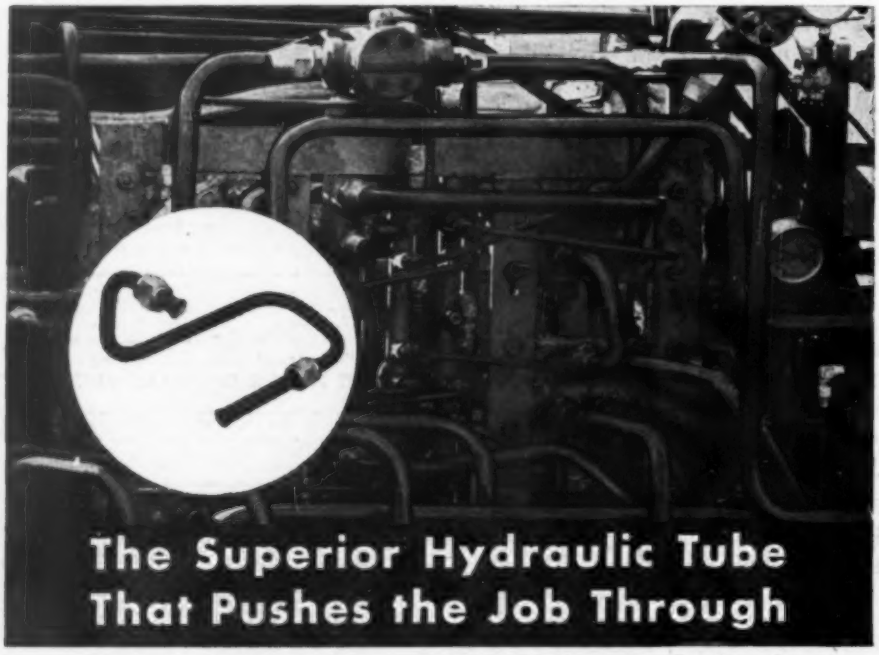
The **Cleco Division** of the Reed Roller Bit Company, Houston, Texas, has announced the appointment of Anna M. Fusco DBA, S. L. Fusco, 4937 E. Olymic Blvd., Los Angeles 22, Pauli and Griffin Co., 509 Sixth Street, San Francisco, William J. Boss Company, Glenn Falls, New York and Bison Machinery & Tool Company, 709 Seneca Street, Buffalo, N. Y. as distributors for Cleco products in their areas.
The new sales office and warehouse of the Cleco Division has been opened at 18071 Wyoming Avenue, Detroit 21, Michigan.

Howard E. Earl
Sundstrand Machine Tool Co.

Howard E. Earl has joined the **Sundstrand Machine Tool Co.**, Rockford, Ill., as chief engineer in charge of engineering for the development of pneumatic and magnetic products. His work will entail coordinating the design and development of new products already being manufactured. Earl was formerly with the Eureka Williams Corporation where he was recently director of research.

William H. McGill
Blackhawk Mfg. Co.

Blackhawk Mfg. Co. has announced the appointment of **William H. McGill** as field representative for the Hydraulic Control Division. McGill was formerly an Eastern district representative for the Oilgear Co. His duties will include the field engineering and sale of hydraulic equipment for use by concerns who incorporate hydraulics into their own products.



Illustrated above is the working portion of a boring rig... and Superior tubing that solved a fabrication problem for a Superior customer.

On this machine the entire boring head is hydraulically controlled ... the failure of any tube in the complex set-up means down-time for the entire machine. What's more, flare and bending requirements are so severe that only the finest hydraulic tubing can meet them.

That's why the Hydraulic Service Company of Cheltenham, Pennsylvania, who fabricate the tubing for this machine looks to Superior for Hydraulic Quality low carbon steel tubing ... tubing that bends better, flares better, stands up better on the job.

If you have a need for Hydraulic Tubing to fit the demands of a tough application—check with Superior. For complete information, free literature and the name of your nearest Superior Distributor, write the Superior Tube Company, 2030 Germantown Ave., Norristown, Pennsylvania.

Superior
THE BIG NAME IN SMALL TUBING
All analyses .010 to ⅝" O.D.
Certain analyses (.035" max. wall) up to 1⅜" O.D.

Hanna Engineering Works, Chicago, has appointed two new sales representatives. Sales in Minnesota and northwestern Wisconsin will be handled by **Haldeman-Langford,** 2580 University Ave., St. Paul 4, Minnesota. Sales in central and southern Indiana and northern Kentucky will be handled by **Scott Equipment & Engineering Co.** of 54 West 30th Street, Indianapolis 8, Indiana.

The **Gerotor May Corporation** has elected **B. Frank Quintillian** as vice-president in charge of engineering. Mr. Quintillian has been associated with Gerotor May for twenty years and has served for several years as chief engineer.

Chiksan Company has established a wholly-owned Canadian subsidiary, to be operated under the name of Chiksan of Canada Ltd. Plant operation in Brantford, Ontario is expected to start early in 1953.

Kaiser Maintenance Men Cut Service Time

SERVICING many hydraulic and pneumatic systems is made particularly troublesome and costly by hard-to-get-at connections. To help their maintenance men speed up difficult wrenching jobs, the Kaiser Steel Corporation has adopted the use of a TAC open end ratchet wrench.

The job pictured here calls for removing and replacing a 1⅛ inch union fitting in a particularly hard-to-get-at location with a limited wrenching arc, on the hydraulic system controlling the operation of the coil car in the temper mill.

Short Working Wrench Arc

The open end wrench design makes it possible for the Kaiser serviceman to slip the wrench head and socket over the tubing and up on to the union fitting where it is speedily ratcheted on or off—with only a seven degree arc wrenching area to work in. When the job is completed, the wrench is simply slipped off the fitting, the openings on the head and socket are realigned, and the wrench is removed.

Joe McCarthy, Kaiser Steel Corporation maintenance serviceman, demonstrates how the open end socket wrench makes a difficult job easy.

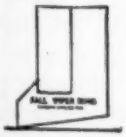
FALL WIPER RINGS

Keeps the Piston Rod CLEAN in Extreme Temperatures —High or Low

FWR-3C

3 Piece Type Spec. AN6231A. Spec. MIL-S-5049

We make sizes AN6231A1-½" to AN6231A71-13"



FWR-2P

2 Piece Type Industrial

Covered by Patents Issued and Patents Pending.

SPRING LOADED with "SQUEEZE-GRIP" ACTION

The piston rods of landing gear, bomb lifts and other hydraulics can be kept absolutely clean and free from all foreign bodies including ice in extreme temperatures high or low with Fall Wiper Rings.

USED DURING WORLD WAR 2

Accepted during world war two and used ever since by the Military is proof the Fall Wiper Ring is correct in design, that it has high quality workmanship strictly adhering to MIL-S-5049 with rigidly controlled inspection.

Made in all sizes for piston rods from ½" to 13" diameter. (Military part numbers range from AN6231A1, ½" diameter to AN6231A71, 13" diameter).

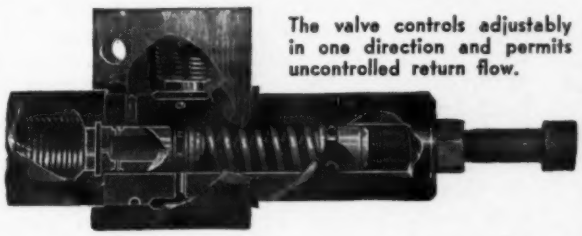
Write, wire or phone us regarding your needs and/or wiper problems.

ACE PRODUCTS CO.

Toledo 1, Ohio, U.S.A. 'Phone ADams 6513

An adjustable
FLOW REGULATOR

This newly perfected adjustable Flow Regulator holds at a constant rate even though the pressure fluctuates.



The valve controls adjustably in one direction and permits uncontrolled return flow.

The spring back piston in the housing is mounted in front of the adjustable screw. It carries a calibrated orifice; operates axially on change in inlet pressure so as to increase the throttling action.

Four sizes, ¼, ⅜, ½, and ¾ inch. Overall length, 4½ to 7½ inches. Adjustable over a 50% flow range. Maximum pressure is 3000 pounds.

Write for illustrated circular A.

WATERMAN ENGINEERING *Company*

725 CUSTER AVENUE • EVANSTON, ILLINOIS

3-WAY FULL AREA, PACKLESS SOLENOID VALVES

SIZES:
1, 1¼, 1½
and 2 inches

We recommend this valve for controlling equipment where pressure must be alternately applied and exhausted as, for example, with diaphragm motor valves, air or hydraulic cylinders, etc. Classed as Bulletin 8331 ASCO Valves, here are a few specifications: pipe sizes 1, 1¼, 1½ and 2 inches. Maximum pressure 125 to 250 pounds; minimum pressure 10 to 20 pounds. Suitable for handling air, water, gas, oil and other non-corrosive gases or liquids up to 180°F.

Since the automatic control of any alternating application and release of pressure is so important for efficient operation, we suggest that you bring your problems to the attention of our engineers. Designing just such controls has been our business for nearly forty years. If Bulletin 8331 Valve doesn't seem to fit your requirements, we have many other types—all in the broad class of automatic control units. Or, if necessary, we shall be glad to design a new type of valve to fit your special needs.

ASCO Solenoid VALVES

If you have recurrent and varying needs for automatic control valves, you should have our General Valve Catalog No. 23.

When in need of Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and Specialized Electromagnetic Controls, come to us.

V.51/5

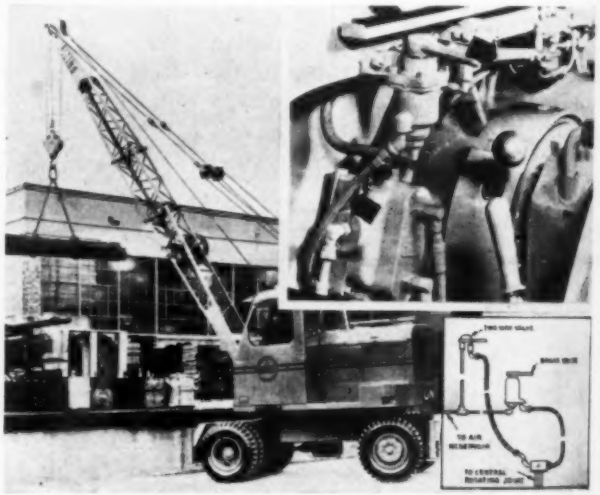
Automatic Switch Co.

385-H LAKESIDE AVENUE • ORANGE, NEW JERSEY

Flexible Metal Hose Solves Air Line Maintenance Problems

DESIGN engineers of the Unit Crane & Shovel Corp., Milwaukee, recently solved the problems of maintenance on air brake and air-operated transmission control lines.

In general, the problems involved piping of compressed air from a reservoir tank, through two-way brake and transmission control valves, and a vertical propel shaft, to a central rotating joint in the undercarriage of the Unit 357 Mobile Crane. From the central rotating joint rigid pressure lines carry compressed air impulses to front and rear axle brake pistons and to the two-speed air operated transmission.



Maintenance of compressed air control lines on this crane was eliminated by installation of pressure, vibration and corrosion proof flexible metal hose. Arrows in upper right inset indicate special pressure lines. Inset at bottom right illustrates schematic diagram of former trouble spots where installation of flexible metal air control lines solved the problem.

Maintenance on these vital pressure lines hinges on preventing any air escape which might cause loss of braking power or transmission control. Due to constant vibration and rough handling of the air lines and valves in service, extremes of stress and wear are routine. Rigid tubing failed during in-field testing, either through wear fracturing or under the stressing of vibration. Maintenance of these controlling air lines in the past has required periodic disassembling of the lines and checking for wear and signs of stressing.

The designers felt that a convoluted metal tube which possessed the permanent strength, stability and safety of all-metal construction and would withstand air pressure, elevated temperatures, vibration and the

corrosive action of lubricants, acids, etc. might provide the solution to this difficult application.

In-field tests using flexible metal hose showed fatigue stressing or metal wear due to vibration no matter how long the metal hose remained in operation. In addition, the flexible metal hose acted as a vibration absorber to eliminate strain and wear around couplings, where other types of air lines were most prone to fail.

The in-field tests also showed that a second reinforcing layer of flat ribbon wire braid around the outside of the air line tubing added considerable resistance to internal pressure and external damaging from accidental mishandling.

It has been found that disassembly of the air lines for maintenance inspection is unnecessary and that the new lines will do the job for the entire service life of the equipment.

Preparing Your Prize Paper . . .

Possible subjects for the APPLIED HYDRAULICS' Prize Paper Contest range from the layout of a central hydraulic system and the design of a fluid power system for a machine tool to the design or modification of a relief valve or a program for leakage control. You can compete for one of seven prizes totalling $1200 by writing the APPLIED HYDRAULICS Contest Editor 1240 Ontario, Cleveland Ohio. You'll be sent an entry blank and suggestions.

Circle 91 on Reader Service Card

New "HIGH" in Pressure Recording

. . . up to 80,000 p.s.i.

Foxboro offers the most complete line of highly accurate pressure instruments available. Diaphragm, spiral and helical spring, and bellows-type elements of phosphor bronze, beryllium copper, steel or stainless steel, for a wide selection of ranges from 2" of water to 10,000 p.s.i. Also, a new heavy-duty helical spring of Type 316 Stainless Steel now provides accurate measurements in full or expanded ranges from 50 to 80,000 p.s.i. . . . even in pulsating service. Choice of round or rectangular cases. For specific information on your problem, write **The Foxboro Company, 2112 Norfolk Street, Foxboro, Mass., U.S.A.**

FOXBORO Reg. U.S. Pat. Off. PRESSURE RECORDERS

COMPRESSED AIR AND GAS COME OUT OF THE LOGAN

ARIDIFIER

Scrubbed CLEAN AND DRY

INSTALL ARIDIFIERS ON LINES SERVING

- Paint Spray Guns
- Air Tools
- Air Hoists
- Foundry Jogging Machines
- Sand Blasting Tools
- Sand Blasting Rooms
- Metal Spray Guns . . . or Wherever the line must deliver clean, dry air or gas

On any air or gas line 92% of the dirt, oil, scale and water that enter the Aridifier is trapped and removed from circulation. The Aridifier's patented centrifugal-baffle action scrubs air and gas clean and dry . . . protects equipment, prevents freezing, fouling, corrosion and caking, produces best results with spray gun and air tool operations, etc. Easy to install. Self cleaning. Maintains itself. 10 models available. Capacity 7 CFM to 17,000 CFM.

Learn HOW the Aridifier scrubs with a patented centrifugal-baffle action.

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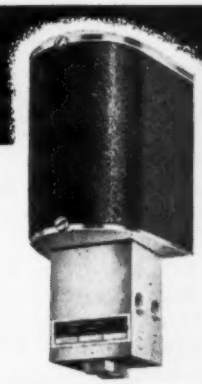
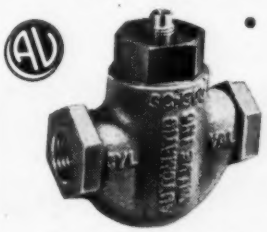
Now!

Logan ENGINEERING CO.
4920 W. Lawrence Ave., Chicago 30, Ill.

Solenoid VALVES

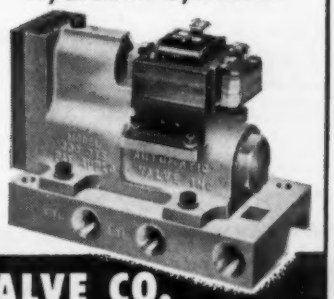
PILOT VALVES
3-WAY 4-WAY
For operating Master Valves and Small Cylinders





Speed Control VALVE
Controls speed of Air and Hydraulic Cylinders

3-Way and 4-Way VALVES
Pilot Operated
Sizes ¼" — ⅜"
½" and ¾"



Write for Bulletin

AUTOMATIC VALVE CO.
37427 GRAND RIVER AVE., FARMINGTON, MICH.

Circle 43 on Reader Service Card

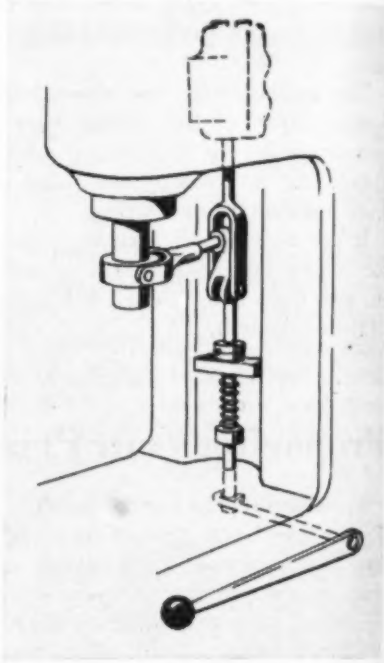
Circle 8 on Reader Service Card

Servo Valve Gives Instant Ram Action

NEW servo type valving in the oil hydraulic circuit used on Denison Engineering Company's Multipress, gives "instant response" ram action. Working through a unique linkage with the hand control, extremely close control over ram speed is accomplished.

Whether the hand lever is pressed rapidly or slowly, the ram follows up to its maximum speed. To any kind of up and down hand motion —long, short, fast, slow—the ram responds instantly. Minimum ram stroke is about 1/16 inch; maximum is six to fifteen inches, depending on the model Multipress.

Here's how it works: The hand lever is depressed to raise the shipper rod (see sketch); this motion is transmited through the clevis and yoke to the valve spool. The spool rises, opens the pressure port of the valve and the ram descends. The ram pulls the telescoping arm down at the same time. This tends to return the spool to its original closed position. The ram stops and remains stationary in a "neutral" position until the control lever is moved again.



Sketch shows linkage between hand lever, hydraulic valve and press ram. Ram speed and pressure is accurately and quickly controlled.

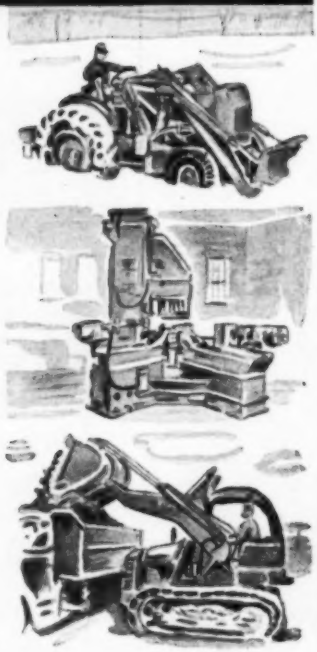
When the ram contacts work, it exerts just as much force as the operator's hand dictates. The pressure gauge on the press tells him the exact force needed to perform a certain job. For production line work the press can then be accurately set for continued application to that job-required pressure.

Safety to Tooling

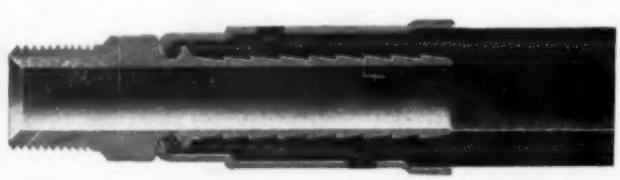
This servo control allows fast ram approach to the work and then when the ram contacts the work, it can be inched carefully (avoiding sudden impact) to provide maximum safety for tooling and fixtures. It offers desirable controlability for varying conditions of die fill, material thickness, etc., as well as straightening, die try-outs, lab testing, and certain types of assembly—in fact, any job that requires careful and individual control of ram speed and pressure.

MULCONROY *Hydraulic*
HOSE ASSEMBLIES

With Triple-Grip
"PRESS-LOCK"
Couplings



With "Press-Lock" Couplings attached, Mulconroy Hose Assemblies provide a new measure of safety, efficiency and economy for all operating or control lines on every type of hydraulic equipment. They are available in three basic hose constructions, to meet any required working pressure; in a full range of sizes and in lengths up to 50 feet. Quickly and easily installed by attaching standard male threaded end of each "Press-Lock" Coupling.



Cut-away view showing unique construction of "Press-lock" Coupling. Note that entire hose wall is employed.

Three-way gripping efficiency is provided by the "Press-Lock" Coupling, as follows: Inner section of hose wall is pressed into corrugations on stem; outer hose wall, with reinforcing wire, is displaced under pressure into openings in coupling sleeve; sleeve is anchored to collar on stem, back of hex portion. Because the entire hose structure is employed in attaching the "Press-Lock"—no part cut away—hose will withstand shock loads and continuous flexing far beyond the limits attainable by use of conventional type couplings for this service.

Write for Illustrated Catalog

"MULCONROY *Starts...* WHERE OTHERS *Stop!*"

MULCONROY CO. *Hose Specialties Since 1887*
5329 JEFFERSON ST., PHILADELPHIA 31, PA.

Judges for Prize Paper Contest

Continued from page 47

Dean M. Cleaveland

Dean M. Cleaveland receievd a B. S. in Chemical Engineering at Ohio State University. After a short period with the Laboratories of the Ohio State Board of Health as an analytical chemist, he was associated with the Pure Oil Company and the Continental Oil Company in both supervisory and sales capacities. Since 1940 he has been Plant Lubrication Engineer for Bendix Products Division of Bendix Aviation Corporation at South Bend, Ind. Mr. Cleaveland is now serving as Chairman of the Technical Committee on Reclamation and Disposal of Industrial Lubricants of the American Society of Lubrication Engineers.

Walter Ernst

Walter Ernst was graduated from the Saxony State College, Dresden, Germany, as a Mechanical Engineer in 1923. After an early professional career in designing reciprocating steam engines, water and steam valves, he served The Hydraulic Press Manufacturing Company successively as development engineer, chief engineer and director of engineering, 1926-45. Since 1945 he has been with Commonwealth Engineering Company of Ohio, first as director of engineering and since November 1945 as vice president in charge of engineering and member of the Board of Directors. Mr. Ernst holds nearly 200 patents, United States and foreign, in the area of applied hydraulics. He is a member of the American Society of Mechanical Engineers and the Engineers' Club of Dayton. Mr. Ernst is the author of "*Oil Hydraulic Power and Its Industrial Applications*" (1949).

Philadelphia Area Engineers Plan Hydraulic Activity

A dinner meeting held at the Philadelphia Engineers Club on Monday, October 27, attracted 122 engineers from the Philadelphia area. Brought together at the invitation of the American Engineering Company, the purpose of the meeting was to determine if sufficient interest among engineers in the area justified the setting up of a specialized activity dealing with industrial fluid power systems. J. S. Bennett, vice president of the host company, served as chairman of the meeting.

Professional Societies

The meeting, which was much larger than anticipated, was enthusiastic for the idea. S. Logan Kerr, consulting engineer of Philadelphia, who represented both the A.S.M.E. and A.S.C.E., presented the point of view of the national societies. Joseph A. Schulcz, consulting engineer and president A.S.C.E., and J. R. Hemeon, hy-

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draulic engineer, Ternstedt Manufacturing Company, Trenton, N. J., also spoke.

After a general discussion from the floor, a ballot was taken to determine the opinions of those attending the meeting. A total of 94 out of 117 voting favored the forming of a society or group under the sponsorship of one of the national engineering societies. A total of 104 signified their intention of joining the society or group when organized. The A.S.M.E. was favored as a sponsoring organization.

Planning Committee

A committee was formed to organize the activity. Mr. Bennett was elected as chairman and in addition to Mr. Kerr and Mr. Hemeon, Loyd G. Wheeler of the Battersby Company; R. S. Quick, manager of engineering, Baldwin-Lima-Hamilton Corp.; J. H. G. McConechy, chief engineer, Sun Ship Building Co.; R. M. Warren, engineering department, New York Shipbuilding Co.; M. T. Gray, M. L. Boyle and J. B. Cutler were selected as committee members. The committee plans a meeting in the near future.

Guests Attended

Among other prominent hydraulic engineers who attended were: H. Balsiger, director of engineering, Landis Tool Co., Waynesboro, Pa.; R. W. Worley, United Engineers and Construction Co. and chairman of the Philadelphia section, A.S.M.E.; E. Washburn, vice president and general manager, American Engineering Co.; E. O. Clark, industrial engineer, Vickers, Inc., Detroit, Mich.; H. A. Vander Kaay, application engineer, Dudco Co. Div. of New York Air Brake Co., Hazel Park, Mich.; and John J. Pippinger, vice president in charge of engineering, Double A Products Co., Manchester, Mich.

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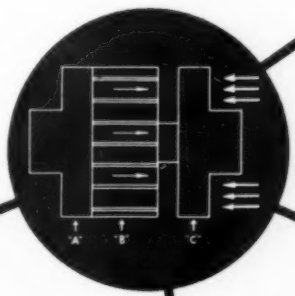

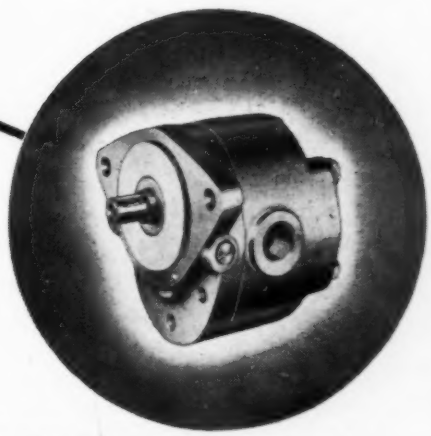

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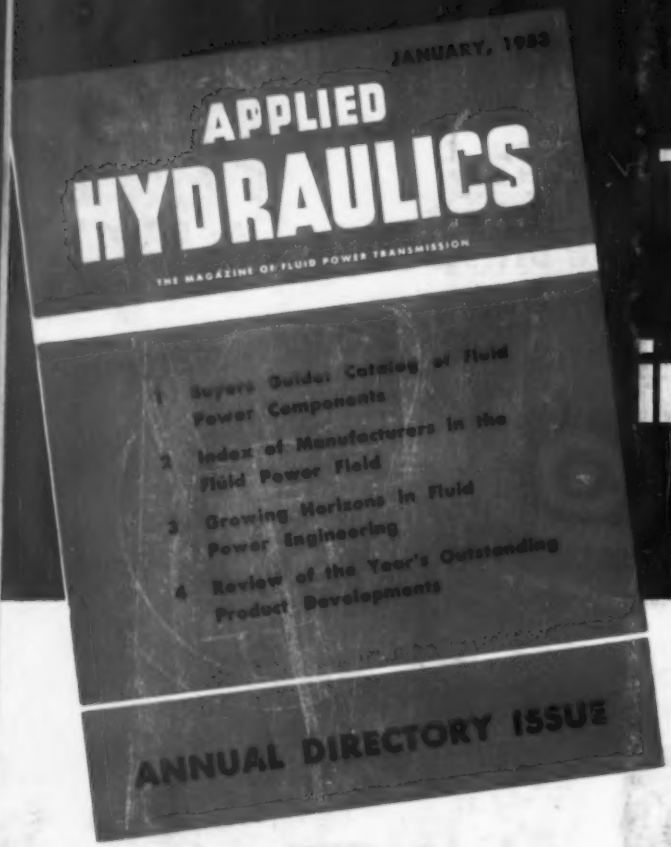
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